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ABSTRACT

These testimonies by Lyon G. Reid to Congress include: "Learning Disabilities and Early Intervention Strategies" (June 6, 2002); "Measuring Success: Using Assessments and Accountability to Raise Student Achievement" (March 8, 2001); "Education Research and Evaluation and Student Achievement: Quality Counts" (May 4, 2000); "Education Research: Is What We Don't Know Hurting Our Children?" (October 26, 1999); "Hearing On Title I (Education of the Disadvantaged) of the Elementary and Secondary Education Act" (July 27, 1999); "Overview of Reading and Literacy Initiatives" (April 28, 1998); and "Hearing on Literacy: Why Kids Can't Read" (July 10, 1997). (SM)

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Testimonies to
Congress

1997 – 2002

G. Reid
Lyon

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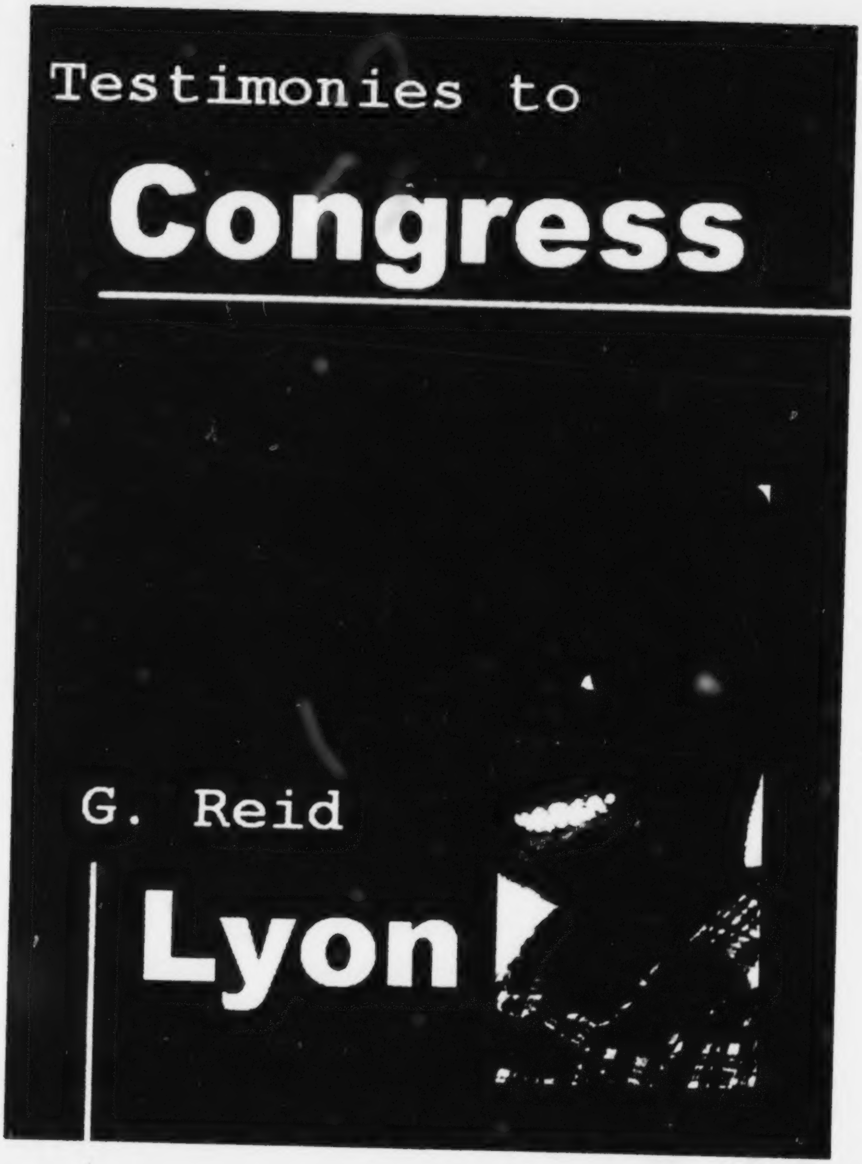

Testimonies to Congress

G. Reid

Lyon

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NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

NATIONAL INSTITUTES OF HEALTH

Statement by G. Reid Lyon, Ph.D.

Chief, Child Development and Behavior Branch

National Institute of Child Health and Human Development

On

LEARNING DISABILITIES AND EARLY INTERVENTION STRATEGIES

For

Subcommittee on Education Reform

Committee on Education and the Workforce

U.S. House of Representatives

Washington, DC

June 6, 2002

Good Morning Chairman Castle and members of the Subcommittee. I am Dr. Reid Lyon, Chief of the Child Development and Behavior Branch at the National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health. I am honored to have been asked by the Subcommittee to address issues relevant to learning disabilities (LD) and early intervention strategies and how research bearing on these issues can serve to inform the special education referral and identification process.

The testimony that I will present for the record this morning will build on the compelling testimony presented by Dr. Pasternack, Assistant Secretary for the Office of Special Education and Rehabilitation Services (OSERS) within the U.S. Department of Education. I would like to note that it is a new day in Washington when you can observe two federal departments – the Department of Health and Human Services and the Department of Education – working collaboratively to identify and address issues that are critical to the health and education of our nation's children. For example, for the first time, the NICHD and OSERS are working hand in hand to ensure that the best research supported by both agencies is integrated and deployed to answer important questions about how to best educate our youngest citizens. Moreover, under the leadership of Secretary Thompson and Secretary Paige, the NICHD is also working closely with Dr. Wade Horn from the Administration for Children and Youth (ACF), Dr. Susan Neuman from the Office of Elementary and Secondary Education and Dr. Russ Whitehurst from the Office of Educational Research and Improvement. This collaboration is designed to develop a coordinated effort to ensure that children from conception to adulthood have access to the most supportive and instructive early childhood environments, preschool, and kindergarten experiences that lead to optimal cognitive, social, emotional, and academic development. Let me now turn to the critical issues to be addressed today.

THE CRITICAL NEED TO IMPROVE IDENTIFICATION AND INSTRUCTIONAL PRACTICES FOR STUDENTS WITH LD

The Subcommittee's focus today on how best to identify and provide effective services to students with LD is critical given that it is the most frequently identified class of disabilities among students in public schools. This focus takes on additional importance because the identification and provision of services to students with LD typically takes place within a context of persistent debate about

(a) the definition of the disability,

(b) the diagnostic criteria and assessment procedures employed in the identification process,

(c) the content, intensity, and duration of instructional practices provided, and

(d) the policies and legal requirements that guide the identification and education of students with LD. What is clear, however, is that Learning Disabilities are real and that objective criteria exist for their identification. The major issue is that the underlying conceptual model for LD is more like obesity or hypertension, not measles or mumps. LD is a dimensional disorder meaning that it exists along a continuum of severity and is not an "either you have it or do not have" type of disability. In this way, it is similar to hypertension or obesity.

INCREASE IN IDENTIFICATION OF LD AT OLDER AGES NOT ACCOMPANIED BY INCREASES IN STUDENT LEARNING

Since the 1976-1977 school year, when Congress first required public schools to document the number of children with LD, the share of school-age students identified as LD has risen from 1.8 percent to 5.2 percent. Learning disabilities now account for more than half of all students enrolled in special education programs, an increase of 22 percent over the past 25 years. In the past decade alone, the number of students ages 6 to 21 identified as LD under IDEA has increased to 38 percent. The largest increase, 44 percent, is among adolescents ages 12-17.

Unfortunately, this rise in the identification of students with LD does not lead to improvements in learning, particularly in older students (9 years of age and above) and particularly in reading skills. For example, Eric Hanushek and his colleagues found that placement in special education was associated with a gain of 0.04 standard deviations in reading and 0.11 standard deviations in mathematics. Unfortunately, these gains are so small that children are not closing the gap between their academic performance and the performance of their higher achieving classmates. This lack of improvement has the further negative effect of keeping students in special education for lengthy periods of time.

This increase in the identification of LD without concomitant improvement in academic achievement among school-age students invites several timely questions. What explains the increase? Is the increase due to improved identification practices? Or is the definition of LD too general and ambiguous to identify younger children at risk for learning failure before they fail? Are some students identified as LD having difficulties learning primarily because of poor instruction? Put another way, does the education profession create instructional casualties by inadequately preparing both general education and special education teachers to address learning differences among children? Once identified, why are special education services not effective in improving learning? Most importantly, can answers to these questions lead to improvements in how LD is defined, how it is identified, how it is prevented, and how children who appear initially refractory to early interventions can be taught with effective remedial strategies?

EXPLANATIONS FOR INCREASES IN IDENTIFICATION OF LD DERIVED FROM CONVERGING RESEARCH FINDINGS

I will propose today, on the basis of strong converging scientific evidence, that the increase in the incidence of LD is related to four factors. First, the vague definition of LD currently in Federal law and the use of invalid eligibility criteria (e.g., IQ-achievement discrepancies) invite variability in identification procedures. For instance, LD identification processes, particularly with regard to how test scores and exclusionary criteria are used, differ across states and even across local school districts within states. Thus, while objective criteria can be established, the identification of students with LD is a highly subjective process at the level of the interdisciplinary team. Here there is considerable variation in how common exclusions for economic, cultural, and linguistic diversity and adequate opportunity to learn are interpreted. This problem is magnified when the variations in criteria are considered. In some states, and even in some local school districts, different diagnostic criteria are used. For example, one state or local district may require a 22 point discrepancy between an IQ score and scores obtained on an achievement test, while another state or district requires more or fewer points, or does not require an IQ-achievement discrepancy calculation at all.

In the state of Connecticut, the prevalence rate of LD in Hartford is 17.4 percent. Hartford is a district serving a relatively poor population. New Haven is similar to Hartford in socioeconomic characteristics, but the prevalence of LD in New Haven is 12.9 percent, roughly three quarters of that in Hartford. On the other hand, Greenwich, one of the wealthiest districts in the state, has a prevalence rate of 16.2 percent while New Canaan, a district similar in socioeconomic characteristics to Greenwich, has a prevalence of LD of 9.5 percent. Hebron, another relatively wealthy community, identifies 7.2 percent of its students as LD. The highest prevalence of LD in Connecticut is found in Canaan, a largely white and working class district, where 23.8 percent of the students are identified as LD. It would be comforting if these differences in prevalence were primarily related to the presence of more effective instructional programs and practices in some districts, but that does not appear to be the case. Rather, the districts employ different standards for identification in an attempt to provide services to children not benefiting from regular education or to respond to parental concerns. And the vague exclusionary-based definition of LD allows these differences in identification practices to occur.

Second, and clearly related to increases in referral for assessment of LD, many teachers have not been prepared to provide differentiated instruction that responds to the different instructional needs that students bring to the classroom. Moreover, traditional approaches to reading instruction in the early grades have substantially underestimated the variability among children in their preparation for learning to read. A significant number of general education teachers report that their training programs did not adequately prepare them to adequately assess learning needs and provide effective reading instruction on the basis of these assessments. This problem is especially acute for students with limited oral language and literacy experiences who arrive in the classroom behind in vocabulary development, print awareness abilities, and phonological abilities. Many of these youngsters have difficulties reading, not because they are LD, but because they are initially behind and did not receive the classroom instruction that can build the necessary foundational language and early reading skills. When teachers feel they are not successful with their students they tend to refer them for specialized services. While some children require these services, many only require enhanced classroom instruction from a well-prepared classroom teacher. Well prepared is the operative term here and when teachers do not receive the benefits of robust training, many children entering their classrooms who require instruction to address these learning needs leave the classrooms as instructional casualties and/or referrals to special education. To serve these students, schools often simply ignore the exclusionary criteria in Federal regulations.

Third, the increase in the identification of students with LD, particularly at the older age ranges, reflects the fact that the remediation of learning difficulties is rarely completely effective after the second grade, particularly as children are commonly served in special education programs in schools. This well-documented finding is primarily due to students falling further and further behind in their academic progress because of reading difficulties and losing motivation to succeed rather than due to limitations in brain plasticity or the closing of "critical periods" in which learning can occur. Consider, during the time that students have been allowed to remain poor readers, they have missed out on an enormous amount of text exposure and reading practice compared to average readers. By one estimate, the number of words read by a middle-school student who is a good reader approaches one million compared with 100,000 for a poor reader. This difference places poor readers at a significant disadvantage with respect to vocabulary development, acquisition of a repertoire of sight words, and the development of reading fluency. In short, reading becomes an onerous chore that is frequently avoided.

Fourth, the assessment and identification practices employed today under the existing definition of LD and the accompanying requirements of IDEA work directly against identifying children with LD before the third grade. Specifically, as Dr. Pasternack explained, the over reliance on the use of the IQ-achievement discrepancy criterion for the identification of LD means that a child must fail or fall below a predicted level of performance before they are eligible for special education services. Because achievement failure sufficient to produce a discrepancy from IQ cannot be reliably measured until a child reaches approximately nine years of age, the use of the IQ-achievement discrepancy literally constitutes a "wait to fail" model. Thus the youngster has suffered the academic and emotional strains of failure for two or three years or even more before potentially effective specialized instruction can be brought to bear. Thus, it is not surprising that our NICHD longitudinal data show clearly that over 70% of children who are poor readers at age nine or older continue to have reading difficulties into adulthood.

In summary, the increases in the incidence of LD over the past quarter century are certainly not due to improved identification practices. Rather, the increases in identification, particularly within the older age ranges, reflect the fact that Federal policy as instantiated in IDEA and resistance to change allow ineffective, inaccurate, and invalid identification practices to continue placing highly vulnerable children at unconscionable further risk.

EXPLANATIONS FOR WHY SPECIAL EDUCATION SERVICES ARE NOT EFFECTIVE IN IMPROVING LEARNING AND ACHIEVEMENT

There are two major reasons why traditional models of special education service provision have proven ineffective. First, the standard "specialized" instruction provided through typical remediation models is frequently too little, too general, and too unsystematic. For example, Sharon Vaughn and her colleagues with support from OSEP studied children with LD in reading who were served for an entire year in public elementary school special education resource rooms. They found that the "special education" was characterized primarily by whole group reading instruction provided to large groups of children (5 to 19) who also varied widely in grade level (grades 3-5). Despite this variation, little individualized or differentiated instruction occurred. This results of this study converges with several other studies identifying the same ineffective practices. For example, in a study supported by NICHD, Barbara Foorman and colleagues found that even with professional development and the introduction of well regarded specialized reading programs, children identified as LD and enrolled in public school elementary resource rooms did not close the gap after a year of instruction. Foorman reported that the instruction was not sufficiently intensive, noting that the class size of 8- 12 per teacher was too large, and estimating that children only received about 6 months of instruction because of time missed moving across classes, field trips, and the like.

Second, and related to an issue discussed earlier, even if the instruction were of high quality, it may be too late to have maximal benefits given that students with LD placed in special education classrooms are already woefully far behind and less motivated to learn to read following one, two, or three years of failure. Joseph Torgesen and associates obtained truly remarkable results in just 8 weeks of two-hour daily lessons with students in Grades 3-5 who had severe LD in reading. But gains in fluency were not apparent, which he attributed to the student's lack of adequate exposure to text and subsequent lack of adequate sight word vocabulary. This problem is an experiential one that is hard to remedy when children can't access print until Grade 3.

IT DOES NOT HAVE TO BE THIS WAY.

The best mainstream scientific research supported by the NICHD and OSEP - – studies that reflect the consensus of experts in such fields as special education, general education, child development, psychology and the neurosciences – indicates that most longstanding differences in defining and educating students with LD stem from inaccurate assumptions about the causes and characteristics of LD. Moreover, there is compelling and converging evidence from these fields that justify investments in early identification and prevention programs for children at risk for LD. This is nowhere more true than with LD in reading, which is by far is the most common and troublesome of the different types of LD, constituting 80 to 90 percent of all students with LD. Fortunately reading disabilities are also the best understood and most effectively corrected learning difficulty if identified and addressed early. Reading disabilities are not the only form of LD- but it is the most prevalent- and even those children with LD in reading may have other LDs, ADHD, and other problems that may not be adequately addressed by a focus on reading. But for many children reading is the primary area of difficulty and even those with other difficulties benefit enormously from improvements in their reading.

There is simply no doubt that if children receive effective instruction early and intensively, they can make large gains in general academic achievement. Indeed, in early intervention and prevention studies supported by the NICHD and OSEP, early intervention with the lowest 20% in Kindergarten and Grade 1 reduced the percentage of students reading poorly to under six percent, and this was accomplished just with enhanced classroom reading instruction. When supplemental reading instruction was provided in small groups, the percentage of children failing to read decreased to fewer than two percent. And, as Assistant Secretary Pasternack pointed out, by reducing reading failure in the majority of students who would fail without proper early intervention, special education resources can now be deployed intensively and with greater provision to that two to six percent of the student population of struggling readers who did not respond to early intervention. These are the children who are rightfully considered LD in reading and for whom special education resources should be concentrated. And at present, it is these children for whom LD is a life long circumstance, and we must work intensively to identify interventions that help individuals compensate for their learning disability if early intervention and remediation are not effective.

We now have substantial scientific evidence that early intervention can greatly reduce the number of older children who are identified as LD in reading, the largest category of children identified for special education. Most of these children also struggle with math and writing, which also improves with early intervention. Without early identification and the provision of effective early intervention, children with LD in one or more of the academic domains defined in IDEA, as well as other students with reading difficulties, will require long-term, intensive and expensive special education programs, many of which continue to show meager results. Early intervention allows ineffective remedial programs to be replaced with effective prevention while providing older students who continue to need specialized services with highly informed and evidenced-based intensive instruction so they can return as quickly as possible to the educational mainstream. This should be the primary focus of special education for students with LD – the instruction of those children who continue to suffer failure in reading, mathematics, and written language, and non- academic domains like problem solving and attention despite well-documented and systematic early instruction.

RECOMMENDATIONS

There are few areas where the relationship of science and policy are more loosely linked that in the area of learning disabilities. In too many instances, policy-related issues have driven the scientific agenda relevant to LD. The situation should be reversed; scientific research should inform policies that address LD. But the production of clear, convergent scientific findings is only the first step. Effecting meaningful change in the lives of children and teachers requires that we not only have sound scientific findings, but that we understand how to formulate policies based on these findings to produce changes at the individual child level.

It is unlikely that the formulators of the original Education for All Handicapped Children Act would conceive that the largest number of students served under the law would be children in a relatively new disability category. And while it is clear that we now have overwhelming evidence that changes are needed in the LD identification and service provision areas, we must expect and anticipate unintended consequences that may follow any changes in current legislative language. I realize that even the best evidence-based recommendations will not be utilized and sustained in practice unless careful thought is given to identifying the conditions that will increase the probability of their successful implementation.

These conditions include our ability to

(1) ensure that all recommendations have been sufficiently tested to acknowledge clearly their strengths and weaknesses and evaluate their specific impact on the children and adults to be served;

(2) ensure that all programs that are implemented on the basis of policy are based upon the highest quality of scientific evidence and are continuously evaluated for the efficacy;

(3) ensure that all policies and programs are held to the highest levels of accountability and linked explicitly to documented improvements in student achievement;

(4) anticipate the effects of changes in policies and practices on federal, state, and local communities and address them effectively;

(5) take into account barriers to change in public school policy and practice;

(6) articulate specific areas where capacity must be developed to ensure successful implementation;

(7) develop and implement explicit transition models to ensure that recommendations to change identification and eligibility criteria are piloted to scale and accompanied by data on the validity, educational outcomes, and costs associated with the changes; and

(8) devote necessary resources to technical assistance and dissemination.

Within the context of these general recommendations, the following specific recommendations are provided:

(1) Replace the muddled exclusionary definition of LD with evidence-based inclusionary definitions through a well-articulated transition process to evaluate validity, cost and effects on student achievement and other outcomes. These definitions must specify and distinguish disabilities in reading, mathematics, written expression, and oral language. The extensive evaluations designed to fit the child into one of the 13 categories of IDEA can be simplified by focusing on assessments of achievement that are directly related to instruction.

(2) Even in a transition phase, there is no need for IQ tests for the identification of children with LD. and the use of the IQ-achievement discrepancy criterion should be discontinued. Validated alternatives exist that have been in place in whole states and districts. Their implementation should be evaluated through a systematic transition process. For example, in most cases, particularly in reading, student underachievement can be predicted on the basis of performance on measures assessing skills directly related to the academic domain in question. In addition, underachievement can be documented by direct comparisons of students' age and grade with their academic functioning in oral language, reading, writing, and mathematics. The key is a broad assessment of achievement directly related to instruction.

(3) Include a student's response to well-designed and well-implemented early intervention as part of the identification process for LD. There is a pressing need for early, intensive, empirically based interventions to be made easily available to children through general education.

No doubt, children who do not benefit from these interventions will require more intensive remediation programs as well as educational accommodations as they proceed through school. In essence, the identification of LD would be reserved for children whose reading and other academic deficits appear to be severe and intractable. This would allow them to receive more comprehensive and intensive help earlier and with greater focus. In turn, this would prompt researchers to more intensive study to determine how the environment, the brain, and heredity interact to impede response to early instruction. This is by no means an attempt to "write off" children who do not respond to aggressive early instruction. To the contrary, it is an attempt to maximize their learning potential through scientifically sound and effective practices.

(4) Related to number 3, ensure that the development and implementation of early identification, prevention and early intervention programs are the joint responsibility of both regular and special education.

(5) Related to number 4, acknowledge the limitations of current teacher preparation programs and models for both general and special educators. The statement that many children are identified, as LD are actually "instructional casualties" is unfortunately all too often accurate. Almost all children can learn to read, for example, if taught appropriately, but many miss out on the help they need because teachers are not adequately prepared. Both special and general educators must be prepared on the basis of the converging scientific evidence of how children learn, why some children have difficulties, and how the most effective instructional approaches can be identified and implemented. All educators should share a common language about these fundamental principles and hold a common dedication and ability to address the needs of students who arrive in their classrooms from highly diverse backgrounds and a range of initial abilities. To do this, teachers must be prepared to identify the characteristics of high quality research and to be able to distinguish between research that is trustworthy and that which is weak and ill informed.

(6) Encourage alternative models for teacher preparation and continuing professional development. It is unlikely that colleges of education will change their current preparation practices in the near future. What is clear is that teachers must be provided the critical academic content, pedagogical principles, and knowledge of learner characteristics that they need in order to impart evidence-based systematic and informed instruction to their students.

AN EXAMPLE OF TRANSLATING SCIENTIFIC RESEARCH INTO PRACTICE

Included in my testimony are additional materials that describe and document how the recommendations noted above can be implemented with success in real schools and real classrooms. I offer for the record a description of how the effectiveness of reading instruction was significantly improved and led to substantial improvements in student reading achievement. The paper that provides this information was written by Ray King, principal of the Hartsfield Elementary School in Tallahassee, Florida and by Dr. Joseph Torgesen, one of the leading reading researchers in the country and an NICHD researcher who is also working closely with OSEP. The specific scientific data relevant to this report have been published in several refereed journals. I would like to draw your attention to the figure that denotes changes in the end-of-year reading performance of children as a function of the implementation of scientifically based early intervention as I provide an overview of the study.

Over a 5-year period, Hartsfield Elementary School worked to implement a comprehensive reading curriculum in kindergarten through grade 3 and to establish significant amounts of preventive reading instruction for children who were performing significantly below grade level in the first and second grade. The school serves a population of children who are about 65% minority and 60% of the students are eligible for free or reduced lunch support. In the first year of the program, the new classroom reading instruction was only partially implemented in all primary grade classrooms. The preventive instruction was phased in gradually beginning in the second year of the project as new resources for providing the instruction were identified. The results for reading skills are provided in the figure that I have provided you. The test used to measure reading skills was a nationally standardized measure of word reading abilities, and individuals other than the children's teachers administered the test at the end of each year to the students.

The figure shows the percentage of children who ended first and second grade performing below the 25th percentile, and it also describes the change in average percentile for all children. As you can see in the figure, during the 5-year implementation period, the percentage of children performing below the 25th percentile at the end of the first grade dropped from 31.8 percent to 3.7 percent. Likewise, during the 5-year implementation period, the percentage of children performing below the 25th percentile at the end of the second grade was only 2.4 percent. In terms of long-term impact of early intervention at Hartsfield Elementary, during the same period of time, the school achieved the largest growth of any of the 20 elementary schools in the district on the state-administered reading test given at the end of the third grade. Moreover, during the project period, the average Metropolitan Reaching Achievement Test scores for the entire third grade increased from the 49th percentile to the 73rd percentile because of the reading improvement observed among the school's lowest performing students. Other low performing schools show similar improvements with the adoption of professional development programs that focus on scientifically-based reading instruction, such as the Pueblo district in Colorado. In the Elk Grove district in California, the reduction in referrals to special education from about 13% to about 9% is widely attributed to implementation of scientifically- based reading instruction programs.

I would also like to draw your attention to the figure that you also have that depicts what occurs in a youngster's brain when that child learns to read through the provision of scientifically-based reading instruction provided by well trained teachers. You will note on the top right side of the figure a left hemisphere of an at risk reader participating in an Interagency Educational research Initiative (IERI) study directed by Dr. Jack Fletcher at the University of Texas Health Science Center in Houston. Dr. Fletcher and his associates were able to identify this child at the end of kindergarten as at risk for reading failure early based on the Texas Primary Reading Inventory, which is used in over 90% of school districts in Texas. They then provided intensive and comprehensive small group reading instruction in Grade 1. At the end of Grade 1, this child, like all but 11 of the approximately 150 children identified as at- risk, is now reading at the average level with good reading fluency and comprehension. Her improved reading abilities are mirrored in increases in brain activity in those left hemisphere neural systems established by NICHD research as responsible for reading. From this picture, one can see that effective early instruction not only helps a child learn to read but in doing so changes the brain to normalized levels of activation as well. Even teachers perform successful brain surgery. All good instruction is brain- based!

In closing, we have learned a great deal over the past twenty-five years about how children learn to read and why some of those youngsters experience difficulties. We have learned a tremendous amount about reading development and reading disabilities and are confident that we can ensure that all but 2 to 6 percent of children can become successful readers under the proper assessment and instructional conditions. While we have a great deal of work to do to enable ALL children to learn to read, the prospects for reducing reading failure in the United States is encouraging.

What is not encouraging is that many in the education and policy communities continue to hold with tenacity to failed convictions. The real tragedy is that conceptualizations of LD have not changed over the past 30 years despite the completion of significant scientific research conducted over the past 15 years by the NICHD and OSEP. What we now know from research must be translated into practice and implemented with care. No Child Left Behind (NCLB) is a great start. The reauthorization of IDEA must be integrated in a seamless fashion with NCLB and IDEA must require that we implement what we have learned from research. Children and their teachers and parents deserve no less.

Thank you Mr. Chairman and I would be happy to answer any questions that you may have.

NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

NATIONAL INSTITUTES OF HEALTH

Statement by G. Reid Lyon, Ph.D.

Chief, Child Development and Behavior Branch

National Institute of Child Health and Human Development

On

MEASURING SUCCESS: USING ASSESSMENTS AND ACCOUNTABILITY TO RAISE STUDENT ACHIEVEMENT

For

Subcommittee on Education Reform

Committee on Education and the Workforce

U.S. House of Representatives

Washington, DC

March 8, 2001

INTRODUCTION

Good morning, Chairman Castle and members of the Subcommittee. I am Dr. Reid Lyon, Chief of the Child Development and Behavior Branch of the National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health. I am pleased to have been asked to address the Subcommittee on issues relevant to the use of assessments and accountability to raise student achievement, particularly with respect to how these issues and our NICHD reading research findings are reflected in President Bush's reading initiatives. It is also timely that you have requested information about how scientifically based early reading instruction will reduce the need for special education. Recently, Dr. Jack Fletcher of the University of Texas Health Science Center in Houston and I completed such an analysis. I am happy to share those findings with you today.

As you know, the NICHD considers that teaching and learning in today's schools reflect not only significant educational concerns but public health concerns as well. Our research has consistently shown that if children do not learn to understand and use language, to read and write, to calculate and reason mathematically, to solve problems, and to communicate their ideas and perspectives, their opportunities for a fulfilling and rewarding life are seriously compromised. Specifically, in our NICHD-supported longitudinal studies, we have learned that school failure has devastating consequences with respect to self-esteem, social development, and opportunities for advanced education and meaningful employment. Nowhere are these consequences more apparent than when children fail to learn to read. Why? Simply stated, the development of reading skills serves as THE major foundational academic ability for all school-based learning. Without the ability to read, the opportunities for academic and occupational success are limited indeed. Moreover, because of its importance, difficulty in learning to read crushes the excitement and love for learning, which most children have when they enter school.

As we follow thousands of children with reading difficulties throughout their school careers and into young adulthood, these young people tell us how embarrassing and devastating it was to read with difficulty in front of peers and teachers, and to demonstrate this weakness on a daily basis. It is clear from our NICHD research that this type of failure affects children negatively earlier than we thought. By the end of first grade, children having difficulty learning to read begin to feel less positive about themselves than when they started school. As we follow children through elementary and middle school years, self-esteem and the motivation to learn to read decline even further. In the majority of cases, the students are deprived of the ability to learn about literature, science, mathematics, history, and social studies because they cannot read grade-level textbooks. Consider that by middle school, children who read well read at least 10,000,000 words during the school year. On the other hand, children with reading difficulties read less than 100,000 words during the same period. Poor readers lag far behind in vocabulary development and in the acquisition of strategies for understanding what they read, and they frequently avoid reading and other assignments that require reading. By high school, the potential of these students to enter college has decreased substantially. Students who have stayed in school long enough to reach high school tell us they hate to read because it is so difficult and it makes them feel "dumb." As a high school junior in one of our studies remarked, "I would rather have a root canal than read."

It is important to note that this state of educational affairs describes an extraordinary and unacceptable number of children. According to the National Center for Educational Statistics (1998), 38 percent of fourth graders nationally cannot read at a basic level--that is, they cannot read and understand a short paragraph of the type one would find in a simple children's book. Unfortunately, reading failure is disproportionately prevalent among children living in poverty. Indeed, in many low income urban school districts the percentage of students in the fourth grade who cannot read at basic level approaches 70 percent.

The educational and public health consequences of this level of reading failure are dire. Of the ten to 15 percent of children who will eventually drop out of school, over 75% will report difficulties learning to read. Likewise, only two percent of students receiving special or compensatory education for difficulties learning to read will complete a four-year college program. Surveys of adolescents and young adults with criminal records indicate that at least half have reading difficulties, and in some states the size of prisons a decade in the future is predicted by fourth grade reading failure rates. Approximately half of children and adolescents with a history of substance abuse have reading problems. It goes without saying that failure to learn to read places children's futures and lives at risk for highly deleterious outcomes. It is for this reason that the NICHD considers reading failure to reflect a national public health problem.

HOW READING DEVELOPS, AND WHY SO MANY OF OUR CHILDREN HAVE DIFFICULTY LEARNING TO READ

Converging scientific evidence obtained from studies supported by NICHD, the Office of Educational Research and Improvement (OERI) and the Office of Special Education Programs (OSEP) of the Department of Education, and the National Science Foundation (NSF), indicates that learning to read is a relatively lengthy process that begins very early in development and clearly before children enter formal schooling. Children who receive stimulating oral language and literacy experiences from birth onward appear to have an edge when it comes to vocabulary development, developing a general awareness of print and literacy concepts, and the goals of reading. If children are read to from their earliest days, they become exposed, in interesting and entertaining ways, to the sounds of our language. Oral language and literacy interactions open the doors to the concepts of rhyming and alliteration, and to word and language play that serves to begin to build the foundation for the development of phonemic awareness--the critical understanding that the syllables and words that are spoken are made up of small segments of sound (phonemes). Vocabulary and oral comprehension abilities are facilitated substantially by rich oral language interactions with adults that might occur spontaneously in conversations and in shared picture book reading.

However, the experiences that help develop vocabulary and general language and conceptual skills in preschoolers are different from the experiences that develop specific types of knowledge necessary to read, including knowledge about print, phonemic awareness, and spelling. These skills need to be explicitly taught. Preschool children who can recognize and discriminate letters of the alphabet are typically from homes in which materials such as magnetized letters and alphabet name books are present and are the source of teaching interactions with parents. Clearly these children will have less to learn when they enter kindergarten. The learning of letter names is also important because the names of many letters contain the sounds they most often represent. With this knowledge, the child is oriented to what is termed "the alphabetic principle"--a principle that explains how sounds of speech (phonemes) become associated with letters of the alphabet (phonics). It is this principle that stands at the core of learning and applying phonics skills to print. Ultimately, children's ability to comprehend what they listen to and what they read is inextricably linked to the depth of their background knowledge. Very young children who are provided opportunities to learn, think, and talk about new areas of knowledge will gain much more from the reading process.

With understanding comes the clear desire to read more and to read frequently, thus ensuring that reading practice and the development of new vocabulary takes place. Through these early interactions and the explicit instruction provided by parents, caregivers, and teachers, skilled readers learn to apply phonemic and phonics skills rapidly and accurately to the text they are reading, practice reading sufficiently to develop fluency, automaticity, and the ability to read with expression, and apply comprehension strategies to what they are reading to facilitate understanding. But it all starts early, with those initial language and literacy interactions that expose the child to the structure of our language and how print works. Unfortunately, few children who later have difficulties learning to read, and particularly children from poverty, come to kindergarten and the first grade with these advantages. We know for example, that the average middle class child is exposed to approximately 500,000 words by kindergarten; an economically disadvantaged child is exposed to half as many, at best.

In essence, children who have difficulties learning to read can be readily observed in the initial stages of their literacy development. They approach the reading of words and text in a laborious manner, demonstrating difficulties linking sounds (phonemes) to letters and letter patterns. Their reading is hesitant and characterized by frequent starts and stops and mispronunciations. Comprehension of the material being read is usually extremely poor. Usually, it is not because he or she is not smart enough. In fact, many children who have difficulty learning to read are bright and motivated to learn to read--at least initially. Their difficulties understanding what they have read occur because it takes far too long to read words, leaving little energy for remembering and comprehending what was read. Unfortunately, the slow and inaccurate reading of words cannot be improved in any appreciable way by using the context of what is read to help pronounce the words correctly. Consequently, while the fundamental purpose of reading is to derive meaning from print, the key to comprehension starts with the rapid and accurate reading of words. In fact, difficulties in decoding unfamiliar words and learning to recognize words rapidly are at the core of most reading difficulties. These difficulties can be traced systematically to initial difficulties in understanding that the language that is heard by the ear is actually composed of smaller segments of sound (e.g., phonemic awareness). And here we come full circle--many of these early difficulties in developing phonemic awareness are due to a lack of literacy and oral language interactions with adults during infancy and early childhood. Thus, because the environments most bereft of these interactions are those characterized by poverty, the cycle continues.

CAN CHILDREN WITH READING PROBLEMS OVERCOME THEIR DIFFICULTIES?

Yes, the majority of children who enter kindergarten and elementary school at-risk for reading failure can learn to read at average or above levels, but only if they are identified early and provided with systematic, explicit, and intensive instruction in phonemic awareness, phonics, reading fluency, vocabulary, and reading comprehension strategies. Substantial research supported by NICHD and OERI shows clearly that without systematic, focused, and intensive interventions, the majority of children rarely "catch up". Failure to develop basic reading skills by age nine predicts a lifetime of illiteracy. Unless these children receive the appropriate instruction, over 70 percent of the children entering first grade who are at risk for reading failure will continue to have reading problems into adulthood. On the other hand, the early identification of children at-risk for reading failure coupled with the provision of comprehensive early reading interventions can reduce the percentage of children reading below the basic level in the fourth grade (e.g., 38 percent) to six percent or less.

ARE CERTAIN EARLY INTERVENTION APPROACHES MORE EFFECTIVE THAN OTHERS?

Yes. On the basis of a thorough evidence-based review of the reading research literature that met rigorous scientific standards, the National Reading Panel (NRP), convened by the NICHD and the Department of Education, found that intervention programs that provided systematic and explicit instruction in phonemic awareness, phonics, guided repeated reading to improve reading fluency, and direct instruction in vocabulary and reading comprehension strategies were significantly more effective than approaches that were less explicit and less focused on the reading skills to be taught (e.g., approaches that emphasize incidental learning of basic reading skills). The NRP found that children as young as four years of age benefited from instruction in phonemic awareness and the alphabetic principle when the instruction was presented in an interesting and entertaining, albeit systematic manner. Likewise, the National Center for Educational Statistics recently reported data from its Early Childhood Longitudinal Study involving 22,000 children showing that, after controlling for family income, youngsters who attended more academically oriented preschool programs had significantly higher scores in reading, math, and general knowledge when tested in the fall of their kindergarten year than children attending less academically oriented preschools. In addition, five NICHD longitudinal early intervention studies examining the effectiveness of different early intervention approaches provided in kindergarten and first and second grades for those children most at-risk for reading difficulties strongly suggested, if implemented appropriately, such programs could reduce the number of children who fail to learn to read well below the 38 percent rate currently observed nationally. It is also important to note that the majority of children composing this unacceptably large group of poor readers ARE NOT provided special education services, as is discussed next.

WILL PROPER READING INSTRUCTION REDUCE THE NEED FOR SPECIAL EDUCATION?

Yes. But it is important to understand at the outset that the number of children with reading difficulties served in special education reflects only a fraction of the number of school age children who fail to learn to read. Recall from the previous discussion that 38% of fourth grade students read below the basic level. Keeping in mind that the majority of these children will continue to have reading difficulties throughout their school career if they do not receive systematic and focused early intervention, we can estimate that at least 20 million school age children suffer from reading failure. Among these 20 million children, only approximately 2.3 million school-age children are served in special education under the category of learning disabilities (LD). The remaining 17.7 million poor readers not meeting the eligibility requirements for the LD category are either provided some form of compensatory education or overlooked all together.

We have taken care in our NICHD early intervention and prevention studies to identify ALL children who are at-risk for reading failure within a given sample and to identify the instructional approaches that are the most effective for the majority of these students, irrespective of whether they are eligible for special education as an LD student or eligible for compensatory education services. As noted earlier, these studies have indicated that with the proper early instruction, the national prevalence of reading failure can be reduced significantly. Thus, by putting in place well designed evidence-based early identification, prevention, and early intervention programs in our public schools, our data strongly show that the 20 million children today suffering from reading failure could be reduced by approximately two-thirds. While still a totally unacceptable rate of reading failure, such a reduction would allow us to provide services to the children who are in genuine need of special education services with substantially greater focus and intensity. Thus, not only can the President's proposal lead to tremendous savings in human capital, but the cost savings will also be significant – savings that can be applied to other pressing educational issues within States and local districts.

HOW THE PRESIDENT'S EARLY READING FIRST AND THE READING FIRST EDUCATIONAL INITIATIVES BUILD ON THE MOST TRUSTWORTHY SCIENTIFIC EVIDENCE AVAILABLE

President Bush has proposed a major reading initiative to:

(1) provide assistance to States and local educational agencies in supporting local efforts to enhance the school readiness of children ages three through five, particularly those from low-income families, through scientific evidence-based strategies and professional development designed to enhance the development of verbal skills, phonemic awareness, pre-reading and basic reading skills, and early language development necessary for optimal reading development in kindergarten and beyond (Early Reading First); and

(2) to provide assistance to States and local educational agencies in establishing scientific research-based reading programs for all children in kindergarten through grade three and the necessary professional development and other support to ensure that teachers can identify children at-risk for reading failure and provide the most effective early instruction to overcome specific barriers to robust reading development (Reading First).

The President's reading initiatives have been developed on the basis of the best scientific evidence and knowledge relevant to reading development, reading difficulties, and reading instruction currently available. The initiatives are also noteworthy for the attention given to

(a) the early identification of children at-risk for reading failure;

(b) the development and implementation of evidence-based prevention and early reading intervention programs at the local level;

(c) the critical need to provide support to States to ensure that schools and teachers have the necessary professional development to identify and/or develop the most effective instructional materials, programs, and strategies;

(d) the critical need to provide support to States and local educational agencies to identify and/or develop the most reliable and valid screening and diagnostic reading assessment instruments that can be used to identify at-risk children and to document the effectiveness of the instructional materials, programs, and strategies; and

(e) the need to strengthen coordination among schools, early literacy programs, and family literacy programs, and to ensure that these programs use evidence-based materials, instructional interventions, and strategies.

Of particular importance within the President's reading initiatives is the requirement that funding for State and local educational agency Early Reading First and Reading First programs is contingent upon objective and rigorous peer review of the grant applications that are submitted. Equally important, the President has stressed the need for States and local educational agencies to monitor and assess funded programs to ensure continued progress and accomplishment of stated objectives for student reading achievement. This review and monitoring process is critical to the development and continuous improvement of these reading programs, and serves an essential capacity-building function by providing extensive feedback to the States and local educational agencies via systematic and objective summaries that serve to hone and elevate the quality of the programs.

In essence, the President's reading initiatives are designed to provide the critical early identification and early reading interventions necessary to prevent reading failure among our Nation's children and to ensure that all children are skilled readers by the end of the third grade. His Reading First and Early Reading First proposals require that participating States and local educational agencies identify and/or develop and implement the necessary screening, assessment, reading intervention approaches, and program evaluation systems on the basis of the highest quality scientific research available. The President's proposals also provide resources for professional development and technical assistance to ensure States and local educational agencies develop the capacity necessary to accomplish this implementation and systematically evaluate the effectiveness of the programmatic efforts. In short, his proposals are predicated on a science of reading development and reading instruction, rigorous peer review and monitoring to ensure high quality program design and implementation, the provision of technical assistance when indicated by peer review, and the systematic assessment of clear and measurable achievement goals to ensure accountability.

THE ISSUE OF ASSESSMENT

The President's proposed reading programs recognize both the importance of assessment and the fact that assessments have multiple purposes, including early identification, diagnosis, program evaluation, and accountability. A single test cannot address all these purposes. For example, a so-called "high-stakes" test can be useful for accountability purposes, but does not provide teachers the information they need to plan instruction, particularly in kindergarten through the second grade. Consistent with the NRC report on high stakes testing, accountability is hard to assess before Grade 3, but if schools and teachers are doing a good job, this should be reflected in accountability assessments in Grade 3.

Let me review four purposes of assessments and how they line up with different types of assessments.

Early identification – NICHD researchers routinely screen large numbers of children to identify those most in need of systematic, focused, and intensive early instruction. Administration of these screening instruments does not require a great deal of time, but it does a good job of informing teachers and schools about those children who are most at risk for subsequent literacy problems. Screening is not diagnostic. That is, it does not provide the teacher with a detailed indication of the child's specific reading problems and needs, but it can certainly save resources that would have to be provided later by identifying those children at greatest need for immediate intervention.

DIAGNOSIS

Identifying instructional needs, which is the purpose of diagnosis, helps the teacher plan instruction. It is closely linked to early identification, as extensive instructional planning is not necessary for every child. Therefore, teachers have more time for instruction by identifying those students most in need. Neither screening for early identification nor diagnostic assessment provides detailed information about how well a program is working or whether a teacher is providing proper instruction. Teachers need better tools for making educational decisions in light of students' performance on these "progress monitoring" assessments. If one seeks to meet the goal of "leaving no child behind," then teachers must know at the earliest possible moment that a student is falling behind, and at the same time, must know how to intervene to prevent the student from falling further behind. The assessment of risk status and educational progress in young children is frequently ignored on the premise that early educational progress is driven largely by maturational factors which dissipate with time, such that differences observed early in development will disappear with age. We know, however, that children do not outgrow reading problems. This attitude toward assessment and early systematic and focused intervention and prevention efforts produces devastating consequences for many young children, particularly children from poverty.

PROGRAM EVALUATION

States and local educational agencies need to know whether programs introduced in their local schools are effective. Within this context, norm-referenced tests can play a critical role, particularly if they are incorporated within research designs that will support inferences relevant to the specific effects of the intervention or program on student achievement. Norm-referenced tests assess transfer of learning. They essentially rank children within their grade level on how well they read. An assessment designed to rank individuals will not generally be effective for diagnosing problems, or providing prescriptive information to inform and guide instructional practices and the specific focus of an intervention. However, such norm-referenced assessments can help determine the "value-added" contribution of specific instructional programs and/or strategies by assessing whether we achieve the ultimate purpose of the reading programs, which is to literally alter the distribution of reading skills in our country and improve the reading of every child.

ACCOUNTABILITY

States and local educational agencies may consider developing assessments that assess mastery of the educational content they deem critical to their academic, economic, and civic success. This type of assessment is usually done through mastery assessments, also known as criterion-referenced tests. Effective assessment in this domain demands clarity in the specification of educational objectives, both with regard to the content to be learned and the skills to be acquired, and the ways in which students must be able to demonstrate content and skill mastery. However, an assessment designed to evaluate mastery of key skills will not generally be effective for distinguishing between students whose performance exceeds a criterion and those who fall short of the mark. As noted earlier, norm-referenced assessments perform this task. Similarly, a norm-referenced assessment that ranks children doesn't address whether teachers are teaching effectively and whether children are mastering what the State and/or the local educational agency deems important. Such assessments should be done yearly beginning in Grade 3 so that we know how well our schools are performing. It is important to keep in mind that mobility rates are very high in inner-city schools, and this degree of mobility must be taken into account when analyzing the results of the assessments. It is also important to keep in mind the concern that this type of assessment leads to schools interpreting accountability as mandating a need for "teaching to the test." In fact, if the standards are good, the curriculum designed to achieve the standards is rich and comprehensive, and the test assesses the standards, this should not be a problem. It certainly is a problem if the test does not assess the standards or results in a narrowing of the curriculum. But that reflects decisions about accountability that should not condemn its importance or the assessment itself – just how it is implemented. And these decisions to teach to a test usually occur at the building level.

The President's reading initiatives ensure that locally determined and implemented programs for the assessment and evaluation of programmatic effectiveness are at the core of this critical program. Indeed, the success of this comprehensive early reading program depends on our knowing what works and what is ineffective, and modifying our efforts as quickly as possible when the latter is identified.

This is a time of great opportunity for the Federal and state governments, local educational agencies, teachers, and parents to work together toward the common objective of eliminating the reading deficit in America. Through scientific inquiry, we have identified the elements of an optimal reading program. We know how to measure a child's progress toward reading with fluency and comprehension. We know how to assist teachers in acquiring the skills necessary to teach reading effectively. We know how to reach the most vulnerable children in our nation with the essential skills they need to learn to read. All that remains now is to apply what we have learned in America's classrooms.

Thank you, Mr. Chairman, for the opportunity to testify on these important topics. I am happy to provide the Subcommittee with references for the research cited in my statement, and will be pleased to respond to any questions you and the members of the Subcommittee may have.

NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

NATIONAL INSTITUTES OF HEALTH

Statement by G. Reid Lyon, Ph.D.

Chief, Child Development and Behavior Branch

National Institute of Child Health and Human Development

On

EDUCATION RESEARCH AND EVALUATION AND STUDENT ACHIEVEMENT: QUALITY COUNTS

For

Subcommittee on Education Reform

Committee on Education and the Workforce

U.S. House of Representatives

Washington, DC

May 4, 2001

Good Morning Mr. Chairman and members of the Committee. I am Dr. Reid Lyon, Chief of the Child Development and Behavior Branch at the National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health (NIH). I am pleased to have been asked to address this Committee on the value and use of education research and evaluation and its benefits to states and local school districts trying very hard to improve student achievement. The NICHD considers that teaching and learning in today's schools is not only a critical educational and social issue, but a significant public health issue as well. Our research has shown that if children do not learn to use language to communicate ideas and perspectives, read and write, calculate and reason mathematically, and be able to solve problems strategically, their opportunities for a fulfilling and rewarding life are seriously compromised. Specifically, in our NICHD longitudinal studies, we have learned that school failure has devastating consequences with respect to self-esteem, social development, and opportunities for advanced education.

TRANSLATING EDUCATION RESEARCH INTO EFFECTIVE INSTRUCTIONAL PRACTICES IN THE CLASSROOM: THE COMPLEXITY AND SCOPE OF THE PROBLEM

Mr. Chairman, historically, education research has not had a significant impact on educational policies and classroom instructional practices. The reasons for this persistent gap between the guidance that education research hopefully provides and the teaching practices that teachers use on a day-to-day basis are many, but three stand out.

THE TRUSTWORTHINESS ISSUE

First, as recently found by the National Reading Panel (NRP), much of the education research published in archival journals and disseminated to researchers, teachers, and policy makers is of uneven, and often not good, quality. It is important to understand that the trustworthiness of any research study is predicated on two major elements:

(1) the suitability of the proposed research design or methodology to address the specific question posed by the study; and

(2) the scientific rigor of the methodology itself. For the results to be trustworthy, a study must use the appropriate methodology and apply it in a rigorous manner. For example, if the question is one of effectiveness---let's say, how effective are specific instructional approaches in teaching children to read--then the only type of research design able to specifically address the question of cause and effect is an experimental or quasi-experimental approach. Such studies are quantitative in nature. In fact, this was the type of research approach selected by the National Reading Panel. To quote the NRP Report, "To make a determination that any instructional practice could be or should be adopted widely to improve reading achievement requires that the belief, assumption, or claim supporting the practice can be causally linked to a particular outcome. The highest standard of evidence for such a claim is the experimental study, in which it is shown that treatment can make such changes and effect such outcomes." (NRP Reports of the Subgroups, p. 1-7).

On the other hand, qualitative research methods and approaches are more exploratory in nature, for example, the intense study in single children of the influence of cultural factors on teaching and learning. Here, the results of qualitative studies can be extremely helpful in generating hypotheses and raising awareness of potential factors that may influence the effectiveness of an intervention. In addition, descriptive, non-experimental research can be useful in building theory, to help shape the design of instructional approaches and interventions, and to help one understand the target or focus for an intervention. The findings of such qualitative-descriptive studies could, in turn, lead to the development and design of more detailed quantitative studies incorporating these observations. Yet it is important to note that qualitative-descriptive research can only suggest instructional approaches or innovative educational strategies to teach students and to lay the groundwork for the development of such strategies. Qualitative-descriptive research cannot identify generalizable strategies that will likely improve academic achievement among students. Only quantitatively-based experimental research can do that. For example, experiments and quasi-experiments have the capability to show us that instructional approaches that seem promising in the descriptive phases of a study do not necessarily help most students learn to read.

The bottom line is that studies that use both types of approaches are important and necessary if we are to develop the fullest and richest understanding of what specific instructional approaches are most effective for which children at which stage of development and under what particular circumstances. But integrating research approaches in a thoughtful and appropriate manner demands a clear understanding of the assumptions underlying each research method and the purposes for which the method is best suited. Over the past years, some educational research may have confused these assumptions and purposes to the detriment to teachers and students.

Research is terribly demanding and is it not sufficient to simply select the most appropriate methodological approach; it is as critical that this methodology be applied rigorously whether it be for quantitative or qualitative studies. For example, in its work examining quantitative studies, the National Reading Panel first established a set of rigorous research methodology standards by which to judge the trustworthiness of each study under review. Again, to quote the Report, "The evidence-based methodological standards adopted by the Panel are essentially those normally used in research studies of the efficacy of interventions in psychological and medical research. These include behaviorally-based interventions, medications or medical procedures proposed for use in the fostering of robust health and psychological development and the prevention or treatment of disease. It is the view of the Panel that the efficacy of materials and methodologies used in the teaching of reading and in the prevention or treatment of reading disabilities should be tested no less rigorously. However, such standards have not been universally accepted or used in reading education research." (NRP Report, p. 5).

Specifically, in the case of quantitative studies designed to test the effectiveness of different reading instructional approaches published over the past 30 years, less than a third of studies met basic scientific criteria. Many studies did not have even the most rudimentary elements of scientific methodology such as adequate control or contrast groups, many did not define study participants or instructional approaches sufficiently to permit application in the classroom or replication by other studies, and many did not measure student achievement outcomes appropriately. Thus it is not surprising that many teachers and researchers have lost faith in the ability of quantitative research to inform instructional practices over the years. Something not done well will have little to offer and little to trust. It remains to be seen whether the extensive qualitative and descriptive education research literature used predominantly over the past decade or more to guide instructional practices contains studies that adhere consistently to the basic principles of reliability, validity, and trustworthiness of the data.

The effects of such limitations in quality on educational policy making and teaching practices are insidious and harmful. Information derived from poorly designed and conducted studies will inevitably produce recommendations that are doomed to failure at the system level, the school level, and the classroom level. Teachers, want, above all, to provide instruction that makes a genuine difference in the lives of their children. They want to use every bit of good information that helps them craft and tailor instructional approaches to meet children's individual learning needs and to elevate the achievement of their students. When teachers turn to research to inform their teaching, they expect and deserve information that is trustworthy. When the information is not, which it typically is, teachers fail, students fail, schools fail, and our Nation fails.

I know first hand the devastating effect that poor quality research has on teaching practices and the trust teachers have in education research. As a young brand new third grade teacher in the mid 1970s I was responsible for teaching 28 students of varying abilities and backgrounds. Many of my students had not yet learned to read which concerned me greatly, but I was informed in my education courses and via the school philosophy that this was to be expected - children learn at their own pace. My school had also adopted a reading curriculum that was based upon the assumption that reading was a natural process, similar to learning to listen and speak. Following this curriculum, I presented reading concepts to children through exposing them to wonderful literature, and attempted to teach phonics concepts incidentally as they appeared in different stories. I also employed the oral language and writing activities that were suggested in my teacher's instructional manual. At the beginning of the year, a third of my students could not read well enough to understand what they had read. Their reading was slow and labored and they mispronounced words constantly. Their spelling was lousy. At the end of the year, the same third of my students could not read well. Their reading remained slow and effortful, the time it took to read text was so great that they could not remember what they read, and their spelling was still lousy. The only change that I could discern was that their motivation to learn to read had waned, and their self-esteem had suffered substantially. Likewise, I felt like a failure, I had let down the children I was responsible for, and I left the classroom teaching profession. I attributed my failure to the fact that I was inexperienced, which I clearly was. It was only later that I came to learn in great depth that the reading instructional approach embraced by my school was not only based upon research that was questionable at best, but that the major assumptions upon which the instructional philosophy and recommended teaching interactions rested had never been adequately tested through well designed studies. I mention this anecdote only to provide a personal explanation for why many teachers lose trust in "research" and eschew educational research findings to guide their practice. Those that stay in the profession learn to simply "wait out" the next "research-based" instructional magic bullet.

While the persistent concern about the trustworthiness of educational research is alarming, even more alarming is the seeming resistance within the educational research community to do anything systematically to increase research quality. Many researchers, school administrators, and education policy makers are currently distracted by debates concerning the specific research approach, quantitative versus qualitative, to inform curricular and teaching practices. Many argue that classroom instruction is far too complex to study adequately by standard experimental or quasi-experimental methods and that qualitative ethnographic and descriptive research findings are more relevant to actual teaching of students in classrooms. Many judge qualitative research, because of its descriptive focus and inability to formally test hypotheses, to be "loose" and less rigorous. It has been said that qualitative research is useful because if the findings are looked at long enough, all predetermined perspectives can be supported. It has also been said that experimental research is too "controlled" to accurately reflect the complexities of classroom life.

Of course, both of these representations are shallow and inaccurate. Both quantitative and qualitative research methods are very useful for specific purposes when selected and used appropriately. The question is not which type of research method is best, but which combination of methods is most appropriate and useful to address specific research questions? The issue is not "either-or." The issue is TRUSTWORTHINESS. Whether specific aspects of a teacher's instructional armamentarium are informed by quantitative, qualitative, and integrated research methods, the power of the research to practice linkage is dependent upon the care, rigor, and methodological excellence which characterizes the studies from which the information is derived.

THE TEACHER PREPARATION ISSUE

No doubt, there is a good deal of educational research that is trustworthy and has been used to inform instructional practices in a productive manner. For example, Bob Slavin's "Success for All" school reform model supported by OERI is based upon substantial research of high quality and undergoes constant evaluation to ensure effectiveness. Likewise, the comprehensive research in beginning reading and the prevention, early intervention, and instructional studies supported by NICHD are being carried out in complex school and classroom environments with good success. A common feature of these two examples is that the school culture and the teachers that apply the research have been specifically prepared to clearly understand and use the results of the research.

No matter how trustworthy a set of research findings might be, the relevance and applicability of the findings will be minimal if teachers and administrators:

(1) cannot access the data;

(2) do not understand and cannot interpret the findings in an accurate and meaningful manner; and

(3) are unable to develop plans and strategies to implement the research in everyday practice. Unfortunately, several recent NICHD supported studies and surveys carried out by Virginia Berninger and her colleagues, and Louisa Moats and by myself in the late 1980s indicate that teachers feel unprepared to address the individual learning needs of their students, and they report that they are particularly under prepared to provide adequate reading instruction. This perception is supported by a recent report from the National Center for Educational Statistics indicating that only one in five teachers feel adequately prepared to teach their students. Why is this the case? Drs. Berninger and Moats have reported that teachers receive insufficient instruction in reading development and reading instruction during their undergraduate, and even graduate studies, with the average teacher completing only one or two reading courses. Surveys of teachers taking these courses indicate consistently that they have not observed professors demonstrate instructional reading methods with children, that course work is frequently superficial and unrelated to teaching practice, and that supervision and guidance during student teaching is fragmentary and inconsistent. Many motivated teachers report that they are left to their own devices to obtain specific skills to improve their instructional practices.

Many teachers report that they do not use educational research findings to guide their teaching practices and many report that they do not trust the idea that research can effectively inform their teaching. This is not unexpected given that it is quite difficult to apply research findings when the information is often of poor quality, lacks authority, is not accessible, is communicated in an incomprehensible manner, and is not practical. Of equal concern is that teachers report that they are not specifically trained in even the most basic approaches to interpreting different types of research studies and are not able to make accurate judgments about the trustworthiness of the research that they do read. Until teachers are provided the necessary basic training to understand how to read and interpret research and how to assess the methodological appropriateness and rigor of the research, they will continue to be buffeted by the capricious pendulum swings that characterize educational fads and instructional practices. This is highly demoralizing. Many teachers find themselves today attempting to implement the latest "research-based" instructional practice only to learn, after it fails, that the research upon which it was based was seriously flawed.

THE RESEARCH TO PRACTICE ISSUE

While research trustworthiness and teacher preparation play significant roles in determining how well research accurately informs educational policies and instructional practices, a critical problem lies in our failure to identify and understand the conditions under which the results of trustworthy research can be implemented and sustained in complex, "real-life" school systems and classrooms. While specific instructional models, approaches and strategies may be found to be effective in relatively controlled settings, there is little detailed knowledge about the factors that foster or impede application of these modalities under varying conditions and contexts, and among diverse populations of students and teachers. We do not yet have a solid grasp of how to "travel" educational innovations, including school reform models and specific classroom management and content instructional practices because our understanding of the cultural, incentive, training, and administrative conditions that will influence this level of "scaling" remains rudimentary. As a Nation, we have only recently begun to invest the necessary human capital, methodological capital, and institutional capital to ensure that large-scale, rigorous, and systematic research can be genuinely translated into improvements in educational practice and student achievement.

COMPLEX, BUT NOT IMPOSSIBLE

Helen Bernstein once said that "if you always do what you've always done, you'll always get what you've always gotten." Educational research can and should play a major role in improving student achievement, but it won't unless significant dedication, intellectual capital, collaborative problem-identification and problem-solving, and a commitment to a systematic and sustained effort are brought to bear on the issues surrounding the translation of research to practice. Some progress has been made over the past five years, but substantial work remains to be done. Allow me to summarize a number of relatively new initiatives that have attempted to address issues of research trustworthiness, teacher preparation, and research translation and provide selected recommendations for your consideration in each of these areas.

RESEARCH TRUSTWORTHINESS

We must raise the trustworthiness, that is, appropriateness and rigor, of all education-related research. It will be important to ensure that all Federally-supported research adhere to the highest standards of excellence and we must encourage privately funded research initiatives to embrace these standards as well. A major first step in this regard is to undertake a comprehensive and systematic analysis of the educational research literature that is relevant to classroom instructional practices, determine the degree to which the research studies meet standard research criteria, and identify the extent to which research of high conceptual and methodological quality converges on particular findings, and determine the readiness of these findings for application in the classroom. Within this context, the National Reading Panel (NRP) has concluded its analysis of the quantitative experimental data base relevant to reading instruction and has presented its findings and determinations to Congress. It is important to note that this Report was able to identify instructional approaches that are ready for classroom implementation. Also important was the finding that a substantial portion of the quantitative and experimental instructional reading research is not capable of informing instruction. These findings provide a clear road map of the gaps that continue to exist in the reading research, and the efforts that will be required to improve research quality, particularly from a methodological standpoint. The NICHD and the OERI are working closely together to develop formal strategic plans to ensure the accurate dissemination of the findings of the NRP and the development of specific strategies to actually implement the findings.

The Federal development and support of the Reading Excellence Act (REA) also represents a major step forward in specifying the types and level of methodological rigor of educational research required to make genuine research-based decisions when selecting and implementing reading approaches and programs. In addition, Federal support for the Interagency Educational Research Initiative (IERI) is a significant collaborative step toward improving not only the quality of educational research, but the identification of the conditions that need to be in place to translate and scale research findings to the necessary level to improve student achievement in complex educational environments. The NICHD and the OERI are working closely together on the continued development and evaluation of the REA and are working with the National Science Foundation in the development and management of the IERI.

At a more local level, the NICHD and the OERI have been working closely together to develop and implement models of the peer-review process to ensure that grant applications receive the attention they deserve from highly qualified researchers with specific expertise in the scientific and educational domains represented in the grants.

In addition to these ongoing efforts, several additional recommendations are offered:

We must develop formal mechanisms to synthesize research that is trustworthy and relevant to instructional practices used in classrooms and with children at-risk for academic failure. A major key to developing a solid and trustworthy research base that will ultimately inform practice is to demonstrate how research findings converge on a particular instructional practice or principle. Research syntheses can also serve a much needed and critical role in assessing the validity of various philosophical and theoretical assumptions that have traditionally guided educational practice before they have been formally evaluated. The tendency in education to shift capriciously from one instructional trend to another is clearly influenced by the field's inability to develop sustained, serious research efforts capable of establishing evidentiary convergence and ensuring replication of findings. Again, the work and the findings of the NRP is a critical step in this process of establishing clear quality standards for research and evaluating and synthesizing existing studies with respect to these criteria. I would like to offer the Report of the National Reading Panel for inclusion in the hearing record.

We must strive to increase the research-based quality of educational materials and programs that are offered commercially to schools. It is generally not appreciated that more often than not, schools purchase educational and instructional materials and text books on the basis of non-scientific factors. Rarely are the instructional methods and procedures recommended in these materials objectively evaluated to determine how effective they are with children of varying abilities and with children in different types of instructional settings. Consumers must ultimately be able to know and understand the strengths and weaknesses of a given educational material or instructional approach and clearly understand the limitations of the research that supports a particular educational product.

The research community must begin to address the tendency to conduct narrowly focused studies, studies that often adhere to philosophical rather than scientific principles. The polarization of research methodologies into a quantitative-qualitative dichotomy reflects a parochial and value-laden perspective that will not advance our knowledge, and will distract the research community from establishing the most compelling research need - TRUSTWORTHINESS. The complex problems that we hope to solve require an answer to this question: Which combinations of research methodologies and approaches are most appropriate for which specific research questions, and how are the methodologies best integrated? Some aspects of some questions will have to be addressed under controlled conditions while contextual, cultural, and organizational factors that influence teaching and learning will require qualitative and ethnographic strategies. However, it is likely that the most helpful and enduring answers will be derived from a careful integration of these perspectives applied at the highest level of scientific integrity.

In addition to increasing research efforts to determine how best to integrate research methods in studying complex educational interactions, a significant need also exists to develop measures that are capable of capturing the essence and authenticity of these complex interactions while at the same time ensuring reliability and validity.

EMPOWERING TEACHERS

If trustworthy research findings are going to be effectively used to inform instructional practices in classroom settings, we must acknowledge that teachers must be provided the necessary basic knowledge to translate research into effective classroom practices. Teachers, who are the most important consumers of research, have been let down in this regard. At a minimum, these recommendations are offered:

Systems of accountability must be developed and put into practice to ensure that all teachers have mastery of the content they are teaching, can deliver instruction through a wide range of approaches and methods, and have a clear understanding of individual differences in their students.

Teachers must be prepared to understand the basic principles underlying the development of the skills that they are teaching and how these principles relate to instructional practice. It is also critical that teachers receive basic training in how to access and interpret the research literature relevant to their instructional responsibilities. It is only in this way that they will be empowered to judge both the quality and applicability of the research findings. All too often, teachers are provided simplistic "magic bullet" solutions to increasing student achievement. Unfortunately and frequently, many instructional approaches have been developed with children in a setting far different from that the teacher now encounters. We must provide teachers with systematic and rigorous training sufficient to develop the ability to evaluate these of claims with confidence.

Teachers must be included in the planning, design, and conduct of educational research that is expected to influence their instructional practices in the classroom. Both researchers and teachers must have the opportunity to develop genuine research collaborations where constant input and feedback are provided bilaterally. This will require substantial changes in the current training of both researchers and teachers.

MOVING TRUSTWORTHY RESEARCH FINDINGS TO SCALE

While the terms "research-based" practices and translational research are terms heard frequently today, there continues to be a paucity of knowledge about how best to implement even the best research information into the daily lives of school administrators, teachers, and students. We don't understand the systemic requirements that are necessary if research is to inform practice in a genuine fashion. We do not yet understand the incentive systems that are critical in helping teachers to modify their belief systems, when appropriate, and incorporate new concepts into their teaching. We don't yet understand how teachers can best be taught to do this. We don't yet understand the amount of time, effort, and resources that are required to address teacher learning, adaptability and change, and we certainly don't yet understand how such things as school district policies and demands, and high stakes assessment influence this process. And most critically, we have not yet developed the fundamental research methods and approaches that can give us a clear view of how different training experiences provided to teachers actually translate into genuine improvements in student achievement. There are long roads to be traveled for both teacher and student. Disentangling and clarifying the multiple influences that can cause positive changes in both teachers and their students will require the thoughtful and sustained integration of rigorous quantitative and qualitative research methods alluded to earlier.

THE HOPE

The NSF, the OERI, and the NICHD have, over the past two years, concentrated on thinking about these issues in depth. Together, we are attempting to build the research infrastructure that will address some of these questions in a productive manner. We are hopeful that the IERI will stimulate the research community to engage in the type of planning and interdisciplinary collaboration that will be absolutely critical to changing the ways in which research is translated effectively into practice. We are hopeful that we have designed the IERI initiative in such a way that the complexity of the research tasks that have to be carried out mirror the complexity of the problems that must be understood. We are convinced that the scientific standards demanded by the IERI will move the field forward, and we are likewise convinced that the peer-review structure and standards that are in place to evaluate IERI grant applications will ensure the research quality that is so sorely needed.

It is also imperative that the Federal investment in education research be predicated on and demand quality efforts from the diverse research community. Likewise, the translation of research to practice will not improve unless the relevant funding agencies and the educational community together understand the urgency to adhere to basic principles of trustworthiness in research. The level of complexity of the problem demands the best of our intellectual and conceptual efforts, the best of our collaborative efforts, and the courage to apply these efforts in a sustained and systematic fashion. There is no question that it can be done and we fervently hope that it will be done.

NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

NATIONAL INSTITUTES OF HEALTH

Statement by G. Reid Lyon, Ph.D.

Chief, Child Development and Behavior Branch

National Institute of Child Health and Human Development

On

EDUCATION RESEARCH: IS WHAT WE DON'T KNOW HURTING OUR CHILDREN?

For

House Science Committee

Subcommittee on Basic Research

U.S. House of Representatives

Washington, DC

October 26, 1999

INTRODUCTION

Good afternoon Mr. Chairman and members of the Subcommittee. I am Dr. Reid Lyon, Chief of the Child Development and Behavior Branch of the National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health (NIH). I am pleased to have been asked to address your Subcommittee on the current state of educational research and the impact of recent developments in neuroscience, cognition, and developmental psychology on education, as well as the contributions of NICHD to the Interagency Education Research Initiative (IERI). The NICHD considers that teaching and learning in today's schools is not only a critical educational and social issue, but also is a significant public health issue. Research has shown that if children do not learn how use language to communicate ideas and perspectives, to read and write, to calculate and reason mathematically, and to solve problems, their opportunities for a fulfilling and rewarding life are seriously compromised. Specifically, in our NICHD longitudinal studies, we have learned that school failure has devastating consequences with respect to self-esteem, social development, and opportunities for advanced education and meaningful employment.

NICHD RESEARCH EFFORTS RELEVANT TO EDUCATION, TEACHING AND SCHOOL LEARNING

The NICHD has developed and supports a large research network consisting of 42 sites in North America, Europe, and Asia that are working in a concerted multidisciplinary fashion to identify:

(1) the critical environmental, experiential, cognitive, genetic, neurobiological, and instructional conditions that foster strong reading and writing development;

(2) the risk factors that predispose children to difficulties in learning to read and write; and

(3) the instructional approaches and procedures that foster optimal reading development, as well as practices and procedures for preventing and remediating reading and writing difficulties.

This research effort has been sustained over the past 34 years, since its inception in 1965, and has been designed to ensure: programmatic coherence and communication among scientists at all 42 sites, accumulation of converging evidence using multiple research methodologies to inform assessment and instructional efforts in an optimal fashion, testing of specific theories and assumptions that guide educational practices, and the translation of basic research findings to classroom settings and practices.

Because many of the studies conducted by scientists in the NICHD Reading and Learning Disabilities Research Network have been devoted to understanding conditions critical to the normal development of oral language, reading, and written language skills, 21,860 children with robust reading and writing skills have been studied, some for as long as 13 years. Likewise, significant programmatic effort has also been deployed to understand why many children have difficulties learning to read and write. To address this issue, 12,641 individuals with reading and writing difficulties and disorders have been studied, many also for as long as 13 years. Moreover, in 1985, the NICHD, building on the knowledge gained from studies addressing reading development and disorders, designed an initiative to develop and apply early identification methods to pinpoint those children during kindergarten and the first-grade who are at risk for reading failure. These studies have provided the foundation for several ongoing prevention, early identification, and instructional studies under way at 12 sites in North America. Since 1985, 7,669 children (including 1,423 good readers) have participated in these reading instruction studies, and 3,600 youngsters are currently enrolled in longitudinal intervention studies in Texas, Washington, Georgia, Massachusetts, New York, Florida, Colorado, California, North Carolina, and Washington, D.C. These studies involve the participation of 1,012 classroom teachers, working in 266 schools and 985 classrooms. Mr. Chairman, I would be pleased to submit a more detailed summary of the NICHD Reading Research Program for inclusion in the hearing record.

This year, the NICHD designed and initiated a systematic research effort to identify the instructional conditions under which children whose first language is Spanish are most likely to succeed in developing English oral language, reading, and literacy skills. Similar to the studies conducted in the English language Reading Research Program, this initiative incorporates a multidisciplinary approach utilizing concepts and methodologies from neuroscience, cognitive and developmental psychology, educational psychology, and reading instruction. The Office of Education Research and Improvement (OERI) within the Department of Education is collaborating with the NICHD in this effort.

In the past five years, the NICHD has also developed a similar initiative to identify critical cognitive, linguistic, neurobiological, experiential, and instructional factors and conditions critical to the development of mathematics calculation and mathematics reasoning skills. We anticipate that this initiative will utilize collaborations with both OERI and the National Science Foundation.

CONCEPTUAL AND METHODOLOGICAL CHARACTERISTICS OF THE NICHD RESEARCH PROGRAMS RELEVANT TO EDUCATION, TEACHING AND LEARNING

Extensive and Long-term Collaborations With the Scientific Community -- The research initiatives described above were developed and designed in close collaboration with scientists in education, psychology, linguistics, special education, pediatrics, neurology, genetics, neuroscience, reading and written language, mathematics, demographics/epidemiology, and quantitative and qualitative research methodologies. The purpose of these collaborations is to identify critical gaps in the scientific knowledge base concerned with

(1) oral language, reading, writing, and mathematics development,

(2) difficulties and disorders in acquiring these academic skills,

(3) the development and application of efficacious instructional-teaching approaches, methods, and strategies, and

(4) the development of research designs that enhance both basic and applied research in these complex educational areas. Scientists from the external research community meet on a formal basis with NICHD program scientists to determine what is known, what is not known, and how best to study critical educational targets to close the knowledge gaps. These collaborations typically result in the setting of a formal research agenda and the publication of a solicitation to stimulate the necessary research.

AN EMPHASIS ON PROGRAMMATIC, COORDINATED, AND SUSTAINED RESEARCH PROGRAMS

The NICHD employs programmatic mechanisms to develop multi-site, multidisciplinary, and multi-methodology research networks that conduct research on a sustained, longitudinal basis. This particular emphasis has consistently resulted in the necessary replication of studies, the accumulation of converging evidence to inform practice and policies, the promotion of essential collaboration across sites, and the integration of critical information about development, learning, and instruction that are informed by multiple disciplines. For example, studies are now under way that incorporate educational, psychological, and neurobiological methods and concepts to determine which teaching approaches are most beneficial for children with reading difficulties and to further determine how brain physiology changes in response to instruction and improvements in reading behavior.

THEORETICALLY BASED AND HYPOTHESIS DRIVEN

NICHD supported research requires that the specific research questions, hypotheses and analytic methods be derived from a carefully considered set of ideas and supporting evidence. The research plan must be exquisitely designed and clear linkages must exist across theoretical elements, hypotheses, measures, and data analytic methods.

MEASUREMENT QUALITY

Standardized tests, laboratory tasks, observational measures, interview schedules, and other assessment/ observational procedures (e.g., dynamic assessments, case studies, ethnographic studies) must be selected for the proposed research on the basis of known reliability, validity, trustworthiness, and appropriateness to the sample(s) under study. Moreover, NICHD initiatives relevant to education also require the measurement of cognitive, linguistic, and academic growth over time to capture changes in development under a variety of conditions and across a variety of settings.

LONGITUDINAL PERSPECTIVE

A major goal of the NICHD research programs relevant to education is to provide long-term improvement in the development of critical cognitive and academic skills. In order to determine if any perceived benefits are produced by different types of instructional approaches and strategies, it is essential that children be studied over time. Longitudinal research has to be the cornerstone of any effort examining cause and effect and the long-term outcome of a range of influences on children's cognitive, behavioral, and academic abilities. Longitudinal designs have enabled us to determine the effects of different reading instructional strategies applied with children differing in cognitive, academic, and sociocultural characteristics, and to apply these findings to classroom practice and policy with confidence. Within the reading domain, longitudinal designs are providing us with the means to determine if different types of interventions that show a positive effect on reading development during preschool, kindergarten, and the primary grades are maintained over time. This is critical given that educational trends and policies, as well as teacher preparation course content, are frequently based upon research that measures the effects of a particular reading instructional strategy at only one point in a child's life and offers absolutely no information about the maintenance and generalizability of the effects of that strategy as youngsters develop and change instructional settings.

AN EMPHASIS ON CLEAR DEFINITIONS OF SAMPLES, METHODS, AND TREATMENT/INSTRUCTIONAL PROCEDURES

NICHD supported educational research must be conducted on samples of individuals who are clearly defined so that independent replication of the study can be accomplished. Specifically, all participants selected for study must be defined with respect to age, grade level (if applicable), gender, ethnicity, socioeconomic status, geographic region, previous and concurrent educational placements and programs, and cognitive, linguistic, and instructional characteristics. Likewise, instructional studies must include rigorous definitions of the exact instructional components, instructional procedures, and instructional settings to ensure that complete and independent replication is possible.

THE USE OF WELL DEVELOPED AND OBJECTIVE PEER (EXPERT) REVIEW PROCEDURES

A hallmark of NIH and NICHD supported research is the emphasis that is placed on the objective and rigorous review and assessment of the quality of the science that is proposed. This same care and quality of review is applied to the NICHD programs of research that are relevant to education. The review process is critical to the development and improvement of research initiatives, and serves these functions by providing extensive feedback to investigators via written critiques that serve to hone and elevate the quality of the science.

CONSISTENT AND REGULAR REFLECTION ON WHAT HAS BEEN LEARNED AND WHAT NEW RESEARCH NEEDS TO BE CONDUCTED

The NICHD program planning process provides a consistent opportunity to evaluate the products derived from ongoing research and to rapidly adapt to scientific opportunities uncovered by the research in progress. In addition, the NICHD research programs relevant to education require that investigators from each of the sites in the research networks meet at least once a year, and frequently several times a year, to evaluate progress, identify common methodological and measurement issues that require modification, and identify critical new areas of research.

SELECTED FINDINGS DERIVED FROM NICHD RESEARCH RELEVANT TO EDUCATION AND THEIR IMPACT ON PRACTICE AND POLICIES

Major advances in our knowledge about reading development, reading difficulties, and reading instruction have been derived from the NICHD supported research initiatives described earlier. Specifically, over the past 34 years a great deal of converging evidence has improved our understanding of how children learn to read, what factors impede reading development, and which instructional approaches are most beneficial at different stages of reading development. We have learned that the development of skilled reading abilities requires the integration of phonological skills, phonics skills, the development of accurate and fluent textual reading capabilities, and the development and application of reading comprehension strategies. We have learned that early language and literacy experiences from birth onward are extremely important in fostering these specific foundational skills. We have developed inexpensive screening and assessment methods to identify children in kindergarten and first grade who are at-risk for reading failure. This is a significant development given that we have also learned that children after the age of nine have an extremely difficult time improving their reading abilities. We have learned that girls are as likely as boys to have difficulties learning to read, but are frequently overlooked in the assessment process and are not likely to receive appropriate specialized instruction. We have learned that some instructional approaches, methods, and philosophies are clearly not appropriate for certain children, but continue to be employed in classrooms due to a lack of adequate teacher preparation in colleges of education. We have also learned that instructional approaches that are designed on the basis of the converging research findings work remarkably well with children who have had difficulties learning to read as long as well trained teachers provide the instruction early enough in the youngsters school tenure.

These research findings have now had some influence on instructional reading practices as well as on Federal and State educational policies and initiatives. The NICHD reading research was relied upon heavily in the development of the Reading Excellence Act and in state educational initiatives in California, Texas, Nebraska, and several other states. However, we have learned that it is extremely difficult to utilize research findings to inform practices in school settings and classrooms. This appears to be due to many factors, including inadequate teacher preparation, the tendency for educational practices and policies to be guided by philosophical and ideological factors rather than scientific factors, and the persistent poor quality of much of the educational research conducted to date. We have found that many teachers and administrators who could benefit from converging research evidence do not yet trust the idea that educational research can inform their teaching. When asked why, they typically report that the research lacks authority, is frequently of poor quality, is not easily accessible, is not practical, and is usually communicated in an incomprehensible manner. Further, many teachers and administrators report that educational research is frequently used to tout a particular instructional magic bullet which typically fails to accomplish what was expected and then is replaced by the next innovation. Analysis of these magic bullets almost always reveals that they are based upon assumptions that have either never been adequately tested or have been assessed using weak research methodology.

THE STATE OF EDUCATIONAL RESEARCH

In 1997, Congress requested that the Director of the NICHD, in consultation with the Secretary of the Department of Education, convene a National Reading Panel (NRP) to determine from existing research the most effective approaches for teaching children to read. While the work of this Panel is still ongoing, their initial efforts have indicated that educational research is in need of improvement. This conclusion has been reached by many others, but the initial NRP findings are instructive.

The NRP has organized its activities to ensure a rigorous and objective evaluation of the quality of research efforts that have been undertaken to inform the reading community about the best approaches for teaching the reading skills of decoding, word recognition, reading fluency, and reading comprehension. The NRP is also evaluating the extant research relevant to teacher preparation and the use of technology to teach reading. The Panel developed a research evaluation methodology and a set of criteria to assess individual studies with respect to

(1) whether the study participants are carefully described;

(2) whether the instructional methods/ procedures are described in sufficient detail to permit independent replication;

(3) whether the fidelity of the instruction being delivered was assessed;

(4) whether there was a full description of outcome measures; and

(5) whether there was an appropriate control or contrast group included in the study. The initial data indicate that the majority of existing studies reported in the educational literature could not be used in a meta-analysis because of a lack of sufficient information or design flaws.

The lack of rigor in traditional educational research is of course due to many complex factors. There appears to be a growing consensus that research carried out within the educational academic community should take place within a more rigorous context, be based on well developed scientific principles, should encourage the integration of multiple disciplines and methodologies, and incorporate an expert peer review system to assess the scientific quality of proposed research. Moreover, for educational research to realize its full potential, a sustained programmatic emphasis must be established to ensure continuity, the analysis of children's learning and response to different forms of instruction over time and across settings, and to provide opportunities for replication. In addition, research training opportunities must be developed and improved in order to equip both researchers in training and education faculty members with a solid foundation in the inquiry skills that are necessary to address well defined gaps in the current knowledge base relevant to teaching and learning.

THE INTERAGENCY EDUCATION RESEARCH INITIATIVE

The goal of the Interagency Education Research Initiative (IERI) is to develop interdisciplinary knowledge and research methods that allow for the implementation and evaluation of large-scale educational interventions, the results of which will inform both educational policy and practice. Of critical interest is the validation of instructional procedures and approaches to enhance reading, mathematics, and science knowledge, and the application of validated approaches on a scale that reflects the complexity of classroom and school system settings and interactions. Within this context, the NICHD has worked closely with the NSF and the OERI to develop the initial solicitation and peer review procedures, and is continuing to work closely with these agencies to prepare a second solicitation for applications. We are confident that initiatives such as the IERI can help to improve the quality of education research by requiring outstanding scientific merit, innovation, and proposed ideas and methods that are capable of testing the applicability of concepts and principles derived from small-scale and highly controlled studies to actual classroom and school system settings. This goal can only be realized through the development of a focused programmatic and sustainable research initiative that is based on the highest scientific standards and the most rigorous peer review process. Moreover, this initiative must continually be refined and improved to ensure that the research that is supported is clearly of a different scope and magnitude than research currently funded by NICHD, OERI, and NSF.

SUMMARY AND CONCLUSIONS

It must be concluded that too little education research conducted over the past century has been based on scientific principles that have proven successful in expanding our knowledge in other arenas critical to child health and development. Indeed, much of the educational research conducted over the past 20 years has been predicated on the notion that scientific findings are relative--in the eyes of the beholder--and that science is not the process of discovering the ultimate truth of nature, but rather a social construction that changes over time. These types of anti-scientific ideologies and philosophical positions have been expressed within a culture of post-modern thinking where a major premise is that there is no genuine scientific method, but rather a sense that anything and everything goes. This is unfortunate. The scientific process has proven itself in every scientific discipline including physics, biology, chemistry, psychology, neuroscience, medicine, and even reading development, reading disorders, and reading instruction.

Educational research is at a crossroads. The educational academic community can choose to be part of the modern scientific community or it can isolate itself and its methods from mainstream scientific thought and progress. The scientific method has been adapted to study and understand the most complex of physical, biological, social, and behavioral systems and interactions. Surely, the teaching and learning process deserves no less. In order to develop the most effective instructional approaches and interventions, we must clearly define what works, the conditions under which it works, and what may not be helpful. This requires a thoughtful integration of experimental, quasi-experimental and qualitative/descriptive methodologies. Education research can be strengthened by beginning to define an exact set of conditions--variables that can be quantified and manipulated--and determine what happens in the presence and absence of these conditions. These observations, no doubt, must be enriched with qualitative insights that add ecological context to the quantitative scaffold. Education research must be open to taking the next step of formulating specific hypotheses that can be tested and confirmed or refuted. By careful experimentation, we now understand and can treat complex conditions that reflect a confluence of biology and environment. If educational research is to participate in, and contribute to the scientific community and the lives of our children, leaders within the academic educational establishment must be willing to show the next generation of educational researchers the way. I am confident it can be done, and hopeful that it will occur in the near future.

I would be pleased to respond to any questions you may have.

NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

NATIONAL INSTITUTES OF HEALTH

Statement by G. Reid Lyon, Ph.D.

Chief, Child Development and Behavior Branch

National Institute of Child Health and Human Development

On

HEARING ON TITLE I (EDUCATION OF THE DISADVANTAGED) OF THE ELEMENTARY AND SECONDARY EDUCATION ACT

For

Subcommittee on Education Reform

Committee on Education and the Workforce

U.S. House of Representatives

Washington, DC

July 27, 1999

Learning to read should be considered a fundamental right in our society today. Reading is necessary skill for succeeding academically in today's schools and also in society. Further, the psychological, social, and economic consequences of reading failure are legion It is for this reason that the NICHD considers that reading failure not only reflects a critical educational issue, but a significant public health problem as well.

NICHD reading research programs, which, to date, have studied over 34,000 children and adults, have taught us that learning to read is a formidable challenge for approximately 60% of our nation's children, and for at least 20% to 30% of these children, reading is one of the most difficult tasks that they will have to master throughout their educational careers.

This is indeed unfortunate. When children do not learn to read, their general knowledge, their spelling and writing abilities, their mathematics skills and their oral language abilities suffer in kind. Learning to read serves as the major avenue to learning about our and other's cultures, societies, and history, not to mention language arts, science, mathematics, and the other content subjects that must be mastered in school. Within this context, reading skills serve as THE major foundational academic ability for all school-based learning. Without the ability to read, the opportunities for academic and occupational success are limited indeed. Moreover, because of its importance, difficulties learning to read squashes the excitement and love for learning that most children enter school with.

It is embarrassing and frequently devastating to read poorly in front of peers and to demonstrate this weakness on a daily basis. It is clear from our NICHD-supported longitudinal studies that follow children from kindergarten into young adulthood that youngsters who read with difficulty are not accustomed to such failure. By the end of the first grade we begin to notice substantial decreases in self-esteem, self-concept, and the motivation to learn to read. As we follow the children through elementary and middle school grades these problems compound, and in many cases our children are unable to learn about the wonders of literature, science, mathematics, and social studies because they cannot read grade-level textbooks. By high school, these student's potential for entering college has decreased to almost nil, with few choices available to them with respect to occupational and vocational opportunities. These students tell us that they hate to read because it is such hard work and they feel stupid. As one adolescent in one of our longitudinal studies remarked recently, "I would rather have a root canal than read".

In short, if we do not teach our children to read, they simply cannot take part in our country's democratic process; their gifts typically go unnoticed, and they are literally disenfranchised from contributing their fullest to their lives and to society.

THE IMPORTANCE OF SCIENTIFICALLY-BASED RESEARCH INSTRUCTIONAL APPROACHES TO READING PROGRAMS

There is no doubt that our nation's children who are most at-risk for reading failure are those who enter school with limited exposure to oral language and literacy interactions from birth until entry into kindergarten and who have little prior understanding of concepts related to phonemic sensitivity, letter knowledge, print awareness, the purposes for reading, and general verbal concepts, including vocabulary. Children raised in poverty, youngsters with limited proficiency in the English language, children with speech and hearing impairments, and children from homes where parent's reading skills and/or practices are limited are clearly predisposed to reading failure. In short, there is an epidemic of reading difficulties among disadvantaged children in the United States. And, it is typically these children who are eligible for and receive instructional assistance via programs made possible through Title I of the Elementary and Secondary Education Act. However, despite the existence of educational programs supported through Title

I funding, the proliferation of reading failure among disadvantaged children continues, in the main, unabated. Why does this unfortunate trend continue, particularly when many Title I educational programs are described as employing research-based instructional approaches? More specifically, given that the term research-based implies that programs have been objectively evaluated to determine for which children the programs are most appropriate, why do so many disadvantaged children continue to flounder in reading? One major reason is that the term research-based currently means many things to many people, with significant variations in the scientific quality of the research described by the use of the term. For example, some instructional reading programs touted as research-based may be based upon mediocre and substantially flawed scientific studies, while other instructional programs are based on studies may meet rigorous scientific criteria for research quality. The problem is that many in the field of education do not know the difference and adherence to scientific quality and scientific criteria has not been the guiding force in selecting and implementing instructional reading approaches in Title I programs. As such, there has been a consistent disconnect between research studies of high scientific quality and the development and implementation of reading approaches and programs in Title I classrooms.

WHAT DOES A RESEARCH-BASED MEAN? WHAT SHOULD IT MEAN?

In a sense, an idea of an appropriate use of the term research-based can be derived from several common-sense questions a parent may ask when attempting to determine if a particular instructional reading approach or program in use in a classroom is appropriate for their child. One general question might be, Ahas this approach or program been used successfully before with children who are similar to mine in language development, reading development, socioeconomic status, and in classrooms and with teachers that are similar to my child's? Likewise, who are the children who did not benefit from the approach or program, and why did they not respond favorably? A second question might be, what are the measures of success? Reading achievement scores? Improvements in motivation and self-concept? Teacher enthusiasm? A third question might be, do the measures or observations of these different aspects of success produce reliable or consistent findings across observers and settings? A fourth question might be how many times has this approach or program been evaluated or studied and similar results obtained? An additional question might be were the research studies upon which the instructional approach or program is based published in a respectable peer-reviewed scientific journal?

In short, common-sense questions like these reflect the scientific essence of the term research-based. Specifically, the instructional approach or program has been developed on the basis of peer-reviewed research that has been conducted with well-defined samples of children similar to those for whom the program will be implemented (representativeness); the data obtained are consistent across measures and observers (reliability); and, the research has been replicated with independent samples. In order for a consumer to determine whether the research basis for an instructional approach or program is representative, reliable, and replicable, the published research study(ies) must describe in sufficient detail the characteristics of the children under study, the characteristics and training of the teachers, the classroom settings, the teacher-student interactions, the specific components of the instructional program, and the research design to permit further independent replication and appropriate implementation of the approach or program.

Too often, discussions among researchers about the term research-based tend to pit those who conduct quantitative research with those who employ qualitative methods in attempting to understand the effects of instructional programs. This type of polarization, similar to debates about whole-language versus phonics approaches to reading instruction, is clearly not productive and confuses parents, teachers, and other consumers about the appropriate use of research in guiding instructional practices. Ultimately, high quality scientific research on instructional reading (and math) programs must combine research strategies that are experimentally responsible, test specific well defined ideas, yield data that are reliable, and are described sufficiently to permit replication, with research methods that provide a qualitative, albeit reliable view of the complexity and the process involved in imparting reading concepts to children of varying abilities in classroom settings. The question is NOT whether quantitative, hypothesis-driven research methods are more powerful than descriptive methodologies embodied in ethnographic studies, case histories, or classroom observation studies. The question which must guide us in establishing a genuine research basis for instruction with children eligible for Title I services is WHICH COMBINATIONS OF RESEARCH METHODS AND APPROACHES ARE MOST APPROPRIATE FOR WHICH SPECIFIC RESEARCH QUESTIONS. Likewise, questions about instructional decisions that reflect an either-or phonics/whole language program choice must be replaced by questions that embrace the complexity of reading instruction. As I have testified earlier before this Committee, this question should be, FOR WHICH CHILDREN, ARE WHICH READING INSTRUCTIONAL APPROACHES/METHODS MOST BENEFICIAL AT WHICH STAGES OF READING DEVELOPMENT IN WHICH CLASSROOM SETTINGS.

STATUS OF SCIENTIFICALLY DERIVED RESEARCH KNOWLEDGE RELEVANT TO READING DEVELOPMENT, READING DIFFICULTIES, AND READING INSTRUCTION

Reading development. Our NICHD-supported reading research program, which consists of 42 sites in North America, Europe and Asia, continues to obtain data that converge on the following findings. Good readers of alphabetic languages (e.g., English) are phonemically aware, understand that the alphabet represents the sounds of speech and can apply this knowledge accurately and fluently to the development and use of phonics skills when reading new and less familiar words. Given the ability to rapidly and automatically decode and recognize words, good readers bring strong vocabularies and good syntactic and grammatical skills to the reading comprehension process, and actively relate what is being read to their own background knowledge via a variety of strategies.

It is also clear from our and other's research that learning to read is a relatively lengthy process that begins very early in development and clearly before children enter formal schooling. Children who receive stimulating literacy experiences from birth onward appear to have an edge when it comes to vocabulary development, an understanding of the goals of reading, and an awareness of print and literacy concepts. Children who are read to frequently at very young ages become exposed in interesting and exciting ways to the sounds of our language, to the concept of rhyming and alliteration, and to other word and language play that serves to provide the foundation for the development of phoneme awareness. As children are exposed to literacy activities at young ages, they begin to recognize and discriminate letters. Without a doubt, children who have learned to recognize and print most letters as preschoolers will have less to learn upon school entry. The learning of letter names is also important because the names of many letters contain the sounds they most often represent, thus orienting youngsters early to the alphabetic principle - a principle that explains how sounds of speech become associated with the letters of the alphabet. Ultimately, children's ability to understand what they are reading is inextricably linked to their background knowledge. Very young children who are provided opportunities to learn, think, and talk about new areas of knowledge will gain much from the reading process. With understanding comes the clear desire to read more and to read frequently, ensuring that reading practice takes place. Unfortunately, few children who are eligible for Title I services come to school and to the reading task with these advantages.

Reading difficulties. NICHD-supported research conducted over the past 35 years has been able to identify and replicate findings which point to a number of factors that can hinder reading development among children irrespective of their socioeconomic level and ethnicity. These factors include deficits in phoneme awareness and the development of the alphabetic principle, deficits in acquiring reading comprehension strategies and applying them to the reading of text, the development and maintenance of motivation to learn to read, and the inadequate preparation of teachers.

DEFICITS IN PHONEME AWARENESS AND THE DEVELOPMENT OF THE ALPHABETIC PRINCIPLE

In essence, children who have difficulties learning to read can be readily observed. The signs of such difficulty are a labored approach to decoding or sounding unknown or unfamiliar words and repeated misidentification of known words. Reading is hesitant and characterized by frequent starts and stops and multiple mispronunciations. If asked about the meaning of what has been read, the child frequently has little to say. Not because he or she is not smart enough; in fact, many youngsters who have difficulty learning to read are bright and motivated to learn to read - at least initially. Their poor comprehension occurs because they take far too long to read the words, leaving little energy for remembering and understanding what they have read.

Unfortunately, there is no way to bypass this decoding and word recognition stage of reading. A deficiency in these skills cannot be appreciably offset by using context to figure out the pronunciation of unknown words. In essence, while one learns to read for the fundamental purpose of deriving meaning from print, the key to comprehension starts with the immediate and accurate reading of words. In fact, difficulties in decoding and word recognition are at the core of most reading difficulties. To be sure, there are some children who can read words accurately and quickly yet do have difficulties comprehending, but they constitute a small portion of those with reading problems.

If the ability to gain meaning from print is dependent upon fast, accurate, and automatic decoding and word recognition, what factors hinder the acquisition of these basic reading skills? As mentioned above, young children who have a limited exposure to both oral language and print before they enter school are at-risk for reading failure. However, many children with robust oral language experience, average to above intelligence and frequent interactions with books since infancy show surprising difficulties learning to read. Why?

In contrast to good readers who understand that segmented units of speech can be linked to letters and letter patterns, poor readers have substantial difficulty in developing this alphabetic principle. The culprit appears to be a deficit in phoneme awareness - the understanding that words are made up of sound segments called phonemes. Difficulties in developing phoneme awareness can have genetic and neurobiological origins or can be attributable to a lack of exposure to language patterns and usage during the preschool years. The end result is the same however. Children who lack phoneme awareness have difficulties linking speech sounds to letters - their decoding skills are labored and weak, resulting in extremely slow reading. As mentioned this labored access to print renders comprehension very difficult.

DEFICITS IN ACQUIRING READING COMPREHENSION STRATEGIES

Some children encounter obstacles in learning to read because they do not derive meaning from the material that they read. In the higher grades, higher order comprehension skills become paramount for learning. Reading comprehension places significant demands on language comprehension and general verbal abilities. Constraints in these areas will typically limit comprehension. In a more specific vein, deficits in reading comprehension are related to:

(1) inadequate understanding of the words used in the text;

(2) inadequate background knowledge about the domains represented in the text;

(3) a lack of familiarity with the semantic and syntactic structures that can help to predict the relationships between words;

(4) a lack of knowledge about different writing conventions that are used to achieve different purposes via text (humor, explanation, dialogue, etc.);

(5) verbal reasoning ability which enables the reader to read between the lines; and

(6) the ability to remember verbal information.

If children are not provided early and consistent experiences that are explicitly designed to foster vocabulary development, background knowledge, the ability to detect and comprehend relationships among verbal concepts, and the ability to actively employ strategies to ensure understanding and retention of material, reading failure will occur no matter how robust word recognition skills are. Unfortunately, our current understanding of how to develop many of these critical language and reasoning capabilities related to reading comprehension is not as well developed as the information related to phoneme awareness, phonics, and reading fluency. We have not yet obtained clear answers with respect to why some children have a difficult time learning vocabulary and how to improve vocabulary skills. Our knowledge about the causes and consequences of deficits in syntactical development is sparse. A good deal of excellent research has been conducted on the application of reading comprehension strategies, but our knowledge of how to help children use these strategies in an independent manner and across contexts is just emerging.

THE DEVELOPMENT AND MAINTENANCE OF MOTIVATION TO LEARN TO READ

A major factor that limits the amount of improvement that a child may make in reading is related to the motivation to continue the learning process. Very little is known with respect to the exact timing and course of motivational problems in the learning to read process, but it is clear that difficulties learning to read are very demoralizing to children. In the primary grades, reading activities constitute the major portion of academic activities undertaken in classrooms, and children who struggle with reading are quickly noticed by peers and teachers. Although most children enter formal schooling with positive attitudes and expectations for success, those who encounter difficulties learning to read frequently attempt to avoid engaging in reading behavior as early as the middle of the first grade year. It is known that successful reading development is predicated on practice with reading, and obviously the less a child practices, the less developed the various reading skills will become. To counter these highly predictable declines in the motivation to learn to read, prevention and early intervention programs are critical.

INADEQUATE PREPARATION OF TEACHERS

As evidence mounts that reading difficulties originate in large part from difficulties in developing phoneme awareness, phonics, reading fluency, and reading comprehension strategies, the need for informed instruction for the millions of children with insufficient reading skills is an increasingly urgent problem. Unfortunately, several recent studies and surveys of teacher knowledge about reading development and difficulties indicate that many teachers are under prepared to teach reading. Most teachers receive little formal instruction in reading development and disorders during either undergraduate and/or graduate studies, with the average teacher completing only two reading courses. Surveys of teachers taking these courses indicates consistently that teachers have never observed professors demonstrate instructional reading methods with children, that course work is superficial and unrelated to teaching practice, and that the supervision of student teaching and practicum experiences is fragmentary and inconsistent. At present, motivated teachers are often left to obtain specific skills in teaching phonemic awareness, phonics, reading fluency, and comprehension on their own by seeking out workshops or specialized instructional manuals.

Clearly teachers who instruct youngsters who display reading difficulties must be well versed in understanding the conditions that must be present for children to develop robust reading skills, and must be thoroughly trained to assess and identify problem readers at early ages. Unfortunately, many teachers and administrators have been caught between conflicting schools of though about how to teach reading and how to help students who are not progressing easily. In reading education, teachers are frequently presented with a "One Size Fits All" philosophy. No doubt, this parochial type of preparation places many children at continued risk for reading failure since it is well established that no reading program should be without all the major components of reading instruction (phoneme awareness, phonics, fluency, reading comprehension). The critical question that our teachers must learn to ask is which children need what, how should it be taught, for how long, and in what type of setting.

It is hard to find disagreement in the educational community that the direction and fabric of teacher education programs in language arts and reading must change. However, bringing about such change will be difficult. In addition, if teacher preparation in the area of language and reading is expected to become more thoughtful and systematic, change in how teaching competencies and certification requirements are developed and implemented is a must. Currently, in many states, the certification offices within state departments of education do not maintain formal and collaborative relationships with academic departments within colleges of education. Thus, the requirements that a student may be expected to satisfy for a college degree may bear little relationship to the requirements for a teaching certificate. More alarming is the fact that both university and a typical State department of education requirements for the teaching of reading may not reflect, in any way, the type and depth of knowledge that teachers must have to ensure literacy for all.

Reading instruction. Currently, NICHD-supported early reading intervention studies are being conducted at 11 sites in North America. These studies involve the participation of 7,669 children, 1,012 teachers, and 985 classrooms in 266 schools. These studies are typically longitudinal in nature and are designed to assess and intervene with those children identified in kindergarten and first grade to be at-risk for reading failure. NICHD-supported studies over the past 35 years have enabled us to develop reliable and valid early identification and assessment methods for this purpose.

Several of these studies involve the participation of children attending urban schools and who are eligible for Title I funding. In the main, the children come from economically disadvantaged homes, participate in the Federal lunch program, and score in the bottom quartile (below the 25th percentile) in emergent and early reading skills. These youngsters who are at-risk for reading failure are identified in kindergarten and first grade, receive reading instruction through one of several reading approaches and programs, and are studied for a five year period to address the question: "For which children are which instructional reading approaches/programs most beneficial at which stages of reading development and in which classroom environments?"

Two such studies of early reading intervention with disadvantaged children that are of particular relevance are currently being conducted in Houston, Texas and Washington, D.C. The Houston study is now in its sixth year while the D.C. study is entering its third year. Currently, there are 1,553 grade 1 and grade 2 children participating in both sites. In the D.C. Early Interventions Project, 12 schools are participating, with nine schools serving as experimental sites and three schools serving as control sites. Within these schools, children from 80 kindergarten, first and second grades are participating in the project. Approximately 98% of the youngsters are African American with an equal number of boys and girls. All of the schools involved in these studies are Title I eligible, with over 75% of the students enrolled eligible for the Federal lunch program. These longitudinal studies are designed to identify the specific instructional components within different reading programs that are most beneficial to at-risk children at specific stages of reading development. In line with our research findings that converge on the necessity of developing phonemic awareness, phonics, fluency, and reading comprehension skills in order to become a skilled reader, these studies seek to understand how best to teach these skills. For example, a critical question that is being addressed is the extent to which the instruction in these skills needs to be highly systematic and explicit through decontextualized letter-sound correspondence rules with textual reading practice in controlled vocabulary material or whether the instruction is more beneficial if presented implicitly through incidental learning gained by feedback on reading authentic literature.

The design and conduct of these studies in classroom settings in public schools is a complex enterprise requiring substantial teacher training, monitoring of the instructional protocols to ensure that the interventions are being carried out correctly, and extensive data collection and analysis. Data describing the effects of different reading intervention components and programs on the reading development of Title I children in Houston were recently published in a prestigious peer-reviewed journal in 1998 and I request that this study be made part of the Congressional Record along with my testimony. Preliminary analysis of the Stanford 9 test results for each participating school have now been completed for the D.C. study and have also been previously presented to the NICHD for review and to the Education and Work Force Committee of the United States Congress. The trends in the preliminary D.C. data converge strongly with the published data obtained at the Houston site. Specially, the research indicates that early instructional intervention makes a difference for the development and outcomes of reading skills in kindergarten, first, and second grade Title I children at-risk for reading failure. However, the results also show that not all instructional approaches have the same impact. Specifically, children who received direct and systematic instruction in phoneme awareness, the alphabetic principal and phonics improved in their word-reading skills at a significantly faster rate than children instructed via implicit approaches employing authentic literature. As with any intervention study, these investigations are designed to follow the children over time to determine if the gains achieved last, and contribute to the development of reading fluency and reading comprehension.

It should be pointed out that these studies are part of a long-term research investment made by the NICHD to first study the normal reading process, identify critical elements necessary for efficient reading, identify the developmental course of those elements or components, develop reliable and valid measurement methods and instruments to map development over time and to predict future reading behavior, apply these predictive instruments to identify children at-risk for reading failure, and to determine which instructional approaches are most effective with at-risk children at different stages in their development of reading skills. To be maximally informative, this type of research program must utilize multidisciplinary talents, must study reading development and response to instruction over time in a longitudinal manner, and adhere to the highest standards of scientific quality. Given that this is the case, we can now move to address the second and third questions asked of this witness by the Education and Workforce Committee.

WHAT IS THE VALUE OF FOCUSING TITLE I SERVICES AND INTERVENTIONS DURING THE ELEMENTARY SCHOOL GRADES

NICHD-supported longitudinal studies that have been ongoing since 1983 clearly indicate that children who are at-risk for reading failure must receive early, intensive, and systematic reading instruction prior to the third grade if long term success is to be expected. At least 75% of children who do not receive such instruction continue to have significant difficulties learning to read into their early adult years. Our NICHD-supported studies underway in Florida do indicate that older elementary and middle-grade children can improve their reading skills to a significant extent, but the degree of instructional intensity and instructional duration is massively greater than that required during kindergarten, and first and second grades. As noted in the above discussion, it is not only the timing of the instructional intervention that is critical, but the nature of the instructional components and how the components are taught. Specifically, early intervention that includes the systematic and direct instruction of phoneme awareness, phonics skills, and reading comprehension strategies within a literature-rich context appears critical to fluent word and text reading and comprehension.

ARE THERE ANY RECOMMENDATIONS THAT CAN BE DERIVED FROM THE NICHD READING RESEARCH PROGRAM THAT THE COMMITTEE MIGHT CONSIDER AS IT PREPARES TO AUTHORIZE TITLE I OF THE ELEMENTARY AND SECONDARY SCHOOL ACT

We feel, as do many others, that an important use of research evidence is to inform educators, parents, scientists, and policy makers so that the decisions that they make will ultimately lead to improvements in student achievement. Making research evidence relevant to policy and practice requires accountability for student learning, accountability for quality teaching, local capacity for research-based decision making, and a continually growing knowledge base that is accessible, trustworthy, and practical. Without accountability for student learning and teacher quality, there is typically only superficial interest in using scientific research to guide instruction. Moreover, once motivated through accountability, teachers, parents, schools and states must have access to research evidence and be able to implement it appropriately.

For the field of education to become a profession in the fullest sense of the term, it must develop and embrace a trustworthy, reliable base of knowledge from which states, schools and individual teachers can draw specific information when making instructional decisions. Other professions have well-established procedures for evaluating research on various approaches and for agreeing how these findings will be used to help guide professional practice. The recently published report from the National Research Council on Preventing Reading Difficulties in Young Children is a first step in this direction. Through the leadership of the United States Congress, the establishment of the National Reading Panel is now in the process of identifying scientific standards that can be applied to educational research and instructional programs, approaches and methods to determine the scientific quality of these products. But we must ensure that we develop vehicles to make solid trustworthy scientific research information available to teachers in an accessible and practical manner. Specifically, all consumers of research information need to know and trust information that identifies which instructional approaches and programs work and for whom. This information must also be provided to policymakers and the public to engender respect and trust in the educational enterprise. What are some specific steps to accomplish these goals.

We must raise the quality and rigor of all education-related research. It will be important to ensure that all Federally-supported research adhere to high standards of research quality and we must encourage privately funded research initiatives to embraces these standards as well.

We need to increase the scale of rigorous educational research. At present, OERI, NSF, and NICHD are collaborating to develop and manage large-scale research on the core topics of reading, mathematics, science, and technology. These collaborations are critically important in the development of consistent quality research standards across Federal agencies and the constituencies that they represent.

We must continually synthesize research of high quality that is relevant to instructional practices with children at risk-for academic failure. The key to developing a solid research base that will ultimately inform practice is to demonstrate how research findings converge on a particular instructional practice or principle. The tendency in education to shift capriciously from one instructional "magic bullet" to another is clearly influenced by the field's inability to develop sustained, serious research efforts capable of establishing convergence and ensuring replication of findings. The National Reading Panel is a critical step in this process of establishing clear quality standards for research and evaluating existing studies with respect to these criteria. I would like to offer the preliminary report from the National Reading Panel for the Congressional Record.

We need to develop a targeted realistic research agenda that is solidly based on the synthesis of research mentioned above. We must clearly understand what we know, what we do not know, and develop comprehensive and continually refined research initiatives designed to close these gaps.

We must strive to improve the quality of consumer information. This might entail a process whereby all Federal agencies adhere to a set of quality research standards for information and materials that are disseminated. Consumers must know and understand the strengths and weaknesses of a given instructional approach, method, or material and must clearly understand the limitations of the research that supports a particular educational product.

We must continue to increase the demand for research-based effective practices and to instill a stronger demand for these practices in all Federal program funding. The funds currently available through the Reading Excellence Act point in the direction of research-based practice more clearly than any Federal legislation to date. This is clearly a critical and important step to ensuring that educational practices are based upon well-defined research foundations.

We must continue to strive to improve the quality and relevance of training teachers at the preservice and inservice levels. No matter how powerful our research findings might ultimately be, the impact of those research investments will be minimal if researchers, professors, teachers, and policy makers do not speak the same language about what constitutes trustworthy quality research and how that information can be implemented in the complex world of classrooms. It is critically important that professional development activities and programs align specifically with ongoing major efforts to employ scientifically research-based practices to enhance student achievement. Our NICHD-supported early intervention studies have taught us that very few practicing teachers are aware of research-based best instructional practices. As such, we must consider developing comprehensive school-based training programs that are coherent, easily accessible, and meaningful to teachers.

NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

NATIONAL INSTITUTES OF HEALTH

Statement by G. Reid Lyon, Ph.D.

Chief, Child Development and Behavior Branch

National Institute of Child Health and Human Development

On

OVERVIEW OF READING AND LITERACY INITIATIVES

For

Committee on Labor and Human Resources

Senate Dirkson Building

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Chairman Jeffords and members of the committee, some children learn to read and write with ease. Even before they enter school, they have developed an understanding that the letters on a page can be sounded out to make words and some preschool children can even read words correctly that they have never seen before and comprehend what they have read. As Marilyn Adams has reported, before school, and without any great effort or pressure on the part of their parents, they pick up books, pencils, and paper, and they are on their way, almost as though by magic.

However, the magic of this effortless journey into the world of reading is available to only about 5% of our nation's children. It is suggested in the research literature that another 20% to 30% learn to read relatively easily once exposed to formal instruction, and it seems that youngsters in this group learn to read in any classroom, with any instructional emphasis.

Unfortunately, it appears that for about 60% of our nation's children, learning to read is a much more formidable challenge, and for at least 20% to 30% of these youngsters, reading is one of the most difficult tasks that they will have to master throughout their schooling.

Why is this so unfortunate? Simply because if you do not learn to read and you live in America, you do not make it in life. Consider that reading skill serves as the major avenue to learning about other people, about history and social studies, the language arts, science, mathematics, and the other content subjects that must be mastered in school. When children do not learn to read, their general knowledge, their spelling and writing abilities, and their vocabulary development suffers in kind. Within this context, reading skill serves as the major foundational skill for all school-based learning, and without it, the chances for academic and occupational success are limited indeed. Because of its importance and visibility, particularly during the primary grades, difficulty learning to read squashes the excitement and love for learning that many youngsters enter school with. It is embarrassing and even devastating to read slowly and laboriously and to demonstrate this weakness in front of peers on a daily basis. It is clear from our NICHD-supported longitudinal studies that follow good and poor readers from kindergarten into young adulthood that our young poor readers are not used to such failure. By the end of the first grade, we begin to notice substantial decreases in the children's self-esteem, self-concept, and motivation to learn to read if they have not been able to master reading skills and keep up with their age-mates. As we follow the children through elementary and middle school grades these problems compound, and, in many cases very bright youngsters are unable to learn about the wonders of science, mathematics, literature and the like because they can not read the grade-level textbooks. By high school, these children's potential for entering college has decreased to almost nil, with few choices available to them with respect to occupational and vocational opportunities. These individuals constantly tell us that they hate to read, primarily because it is such hard work, and their reading is so slow and laborious. As one adolescent in one of our longitudinal studies remarked recently, "I would rather have a root canal than read ".

While failure to learn to read adequately is much more likely among poor children, among nonwhite children, and among nonnative speakers of English, recent data derived from the National Assessment of Educational Progress (1994) reveals an alarming trend. In the State of California, 59% of fourth grade children had little or no mastery of the knowledge and skills necessary to perform reading activities at the fourth grade level, compared to a national average of 44% below basic reading levels. Even more alarming, is that this evidence of serious reading failure cuts across all ethnic and socioeconomic variables. While 71% of African-Americans, 81% of Hispanics and 23% of Asians were reading below basic levels, 44% of white students in the fourth grade were also below the basic reading level necessary to use reading as a skill. Moreover, 49% of the fourth grade children in California who were reading below basic levels were from homes where the parents had graduated from college. In fact, the children of college-educated parents in California scored lowest with respect to their national cohort. These data underscore the fact that reading failure is a serious national problem and cannot simply be attributed to poverty, immigration, or the learning of English as a second language. The psychological, social, and economic consequences of reading failure are legion.

It is for this reason that the National Institute of Child Health and Human Development (NICHD) within the National Institutes of Health (NIH) considers reading failure to reflect not only an educational problem, but a significant public health problem as well. Within this context, a large research network consisting of 41 research sites in North America, Europe, and Asia are working hard to identify

(1) the critical environmental, experiential, cognitive, genetic, neurobiological, and instructional conditions that foster strong reading development;

(2) the risk factors that predispose youngsters to reading failure; and

(3) the instructional procedures that can be applied to ameliorate reading deficits at the earliest possible time. The NICHD has supported research to understand normal reading development and reading difficulties continuously since 1965. During the past 33 years, NICHD supported scientists have studied the reading development of 34,501 children and adults. Many studies have been devoted to understanding the normal reading process, and 21,860 good readers have participated in investigations, some for as long as 12 years. Significant effort has also been deployed to understand why many children do not learn to read. To address this critical question, 12,641 individuals with reading difficulties have been studied, many for as long as 12 years. In addition, since 1985, the NICHD has initiated studies designed to develop early identification methods that can pinpoint children during kindergarten and the first grade who are at-risk for reading failure. These studies have provided the foundation for several prevention and early intervention projects now underway at 11 sites in the U.S. and Canada. Since 1985, 7,669 children (including 1,423 good readers) have participated in these reading instruction studies, and 3,600 youngsters are currently enrolled in longitudinal early intervention studies in Texas, Washington, Georgia, Massachusetts, New York, Florida, Colorado, North Carolina, and Washington, D.C. These studies have involved the participation of 1,012 classroom teachers, working in 266 schools and 985 classrooms. (A summary of the NICHD Reading Research Program is included with this testimony). With this as background, my remaining testimony will focus on addressing several major questions that may be of interest to the Committee on Labor and Human Resources on the topic of Reading and Literacy Initiatives. These questions are:

1) How Do Children Learn To Read?

2) Why Do Some Children (and Adults) Have Difficulties Learning to Read?

3) How Can We Help Children Learn to Read? For Which Children Are Which Teaching Approaches Most Beneficial At Which States of Reading Development?

HOW DO CHILDREN LEARN TO READ?

UNDERSTANDING HOW SOUNDS ARE CONNECTED TO PRINT

In general, learning to read the English language is not as easy as conventional wisdom would suggest. Every type of writing system whether it be a syllabic system as used by the Japanese, a morphosyllabic system as used by the Chinese (where a written symbol represents a unit of meaning), or an alphabetic system that is used in English, Spanish, and Scandinavian languages (to name a few) present challenges to the beginning reader. For example, in an English alphabetic system, the individual letters on the page are abstract and meaningless, in and of themselves. They must eventually be linked to equally abstract sounds, called phonemes, blended together, and pronounced as words, where meaning is finally realized. To learn to read English, the child must figure out the relationship between sounds and letters. Thus, the beginning reader must learn the connections between the 40 or so sounds of spoken English (the phonemes), and the 26 letters of the alphabet. What our NICHD research has taught us is that in order for a beginning reader to learn how to connect or translate printed symbols (letters and letter patterns) into sound, the would-be reader must understand that our speech can be segmented or broken into small sounds (phoneme awareness) and that the segmented units of speech can be represented by printed forms (phonics). This understanding that written spellings systematically represent the phonemes of spoken words (termed the alphabetic principle) is absolutely necessary for the development of accurate and rapid word reading skills.

Why is phoneme awareness so critical for the beginning reader? Because if children cannot perceive the sounds in spoken words - for example, if they cannot "hear" the "at" sound in "fat" and "cat" and perceive that the difference lies in the first sound - they will have difficulty decoding or "sounding out" words in a rapid and accurate fashion. This awareness of the sound structure of our language seems so easy and commonplace that we take it for granted. But many children do not develop phoneme awareness, and for some interesting reasons that we are now beginning to understand. Unlike writing, the speech we use to communicate orally does not consist of separate sounds in words. For example, while a written word like "cat" has three letter-sound units, the ear hears only one sound, not three, when the word "cat" is spoken aloud. This merging and overlapping of sounds into a sound "bundle" makes oral communication much more efficient. Consider how long it would take to have a conversation if each of the words that we uttered were segmented or "chopped" into their sound structure. In essence we would be spelling aloud the words that we were speaking. From the NICHD studies that were initiated in 1965 to understand how the reading process develops, we now have strong evidence that it is not the ear that understands that a spoken word like "cat" is divided into three sounds and that these discrete sounds can be linked to the letters C-A-T, it is the brain that performs this function. In some youngsters, the brain seems to have an easy time processing this type of information. However, in many children, the skill is only learned with difficulty, and thus must be taught directly, explicitly, and by a well-trained and informed teacher. It has also become clear to us that the development of these critical early reading-related skills such as phoneme awareness and phonics are fostered when children are read to at home during the preschool years, when they learn their letter and number names, and when they are introduced at very early ages to concepts of print and literacy activities.

Does this mean that children who have a difficulty understanding that spoken words are composed of discrete individual sounds that can be linked to letters suffer from brain dysfunction or damage? Not at all. It simply means that the neural systems that perceive the phonemes in our language are less efficient than in other children. This difference in neural efficiency can also be hypothesized to underlie the individual differences that we see every day in learning any skill such as singing, playing an instrument, constructing a house, painting a portrait, and the like. In some cases, our NICHD studies have taught us that the phonological differences we see in good and poor readers have a genetic basis. In other children, the differences seem to be attributable to a lack of exposure to language patterns and literacy-based interactions and materials during the preschool years.

As pointed out, the development of phoneme awareness, the development of an understanding of the alphabetic principle, and the translation of these skills to the application of phonics in reading words are non-negotiable beginning reading skills that ALL children must master in order to understand what they read and to learn from their reading sessions. Printed letters and words are the basic data on which reading depends, and the emerging reader must be able to recognize accurately and quickly spelling patterns and their mappings to speech. To recapitulate, these skills are supported nicely when children receive an abundance of early literacy experiences in the home and in preschool. But the development of phoneme awareness and phonics, while NECESSARY, are NOT SUFFICIENT, for learning to read the English language so that meaning can be derived from print. In addition to learning how to "sound out" new and/or unfamiliar words, the beginning reader must eventually become proficient in reading, at a very fast pace, larger units of print such as syllable patterns, meaningful roots, suffixes, and whole words.

THE DEVELOPMENT OF READING FLUENCY

While the ability to read words accurately is a NECESSARY skill in learn to read, the speed at which this is done becomes a critical factor in ensuring that children understand what they read. As one child recently remarked, "if you don't ride a bike fast enough, you fall off". Likewise, if the reader does not recognize words quickly enough, the meaning will be lost. Although the initial stages of reading for many students require the learning of phoneme awareness and phonics principles, substantial practice of those skills, and continual application of those skills in text, fluency and automaticity in decoding and word recognition must be acquired as well. Consider that a young reader (and even older readers for that matter) has only so much attentional capacity and cognitive energy to devote to a particular task. If the reading of the words on the page is slow and labored, the reader simply cannot remember what they have read, much less relate the ideas they have read about to their own background knowledge. Children vary in the amount of practice that is required for fluency and automaticity in reading to occur. Some youngsters can read a word only once to recognize it again with greater speed; others need more than 20 or more exposures. The average child needs between four and 14 exposures to automatize the recognition of a new word. Therefore, in learning to read, it is vital that children read a large amount of text at their independent reading level (95% accuracy), and that the text format provides specific practice in the skills being learned.

CONSTRUCTING MEANING FROM PRINT

The ultimate goal of reading instruction is to enable children to understand what they read. Again, the development of phoneme awareness, phonics skills, and the ability to read words fluently and automatically are NECESSARY but NOT SUFFICIENT for the construction of meaning from text. The ability to understand what is read appears to be based on several factors. Children who comprehend well, seem to be able to activate their relevant background knowledge when reading - that is, they can relate what is on the page to what they already know. Good comprehenders also have good vocabularies, since it is extremely difficult to understand something you cannot define. Good comprehenders also have a knack for summarizing, predicting, and clarifying what they have read, and frequently use questions to guide their understanding. Good comprehenders are also facile in employing the sentence structure within the text to enhance their comprehension.

In general, if children can read the words on a page accurately and fluently, they will be able to construct meaning at two levels. At the first level, literal understanding is achieved. However, constructing meaning requires far more than literal comprehension. Children must eventually guide themselves through text by asking questions like. "Why am I reading this and how does this information relate to my reasons for doing so?", "What is the author's point of view?", "Do I understand what the author is saying and why?", "Is the text internally consistent?", and so on. It is this second level of comprehension that leads readers to reflective, purposeful understanding.

The development of reading comprehension skills, like the development of phoneme awareness, phonics, and fluency, needs to be fostered by highly trained teachers. Recent research shows that the teacher must arrange for opportunities for students to discuss the highlights of what they have read and any difficulties they have had when reading. Because the grammatical structures of written text are more varied and complex than those of casual, oral language (speaking to one another), regular exploration and explicit instruction on formal syntax is warranted. Children's reflections on what they have read can also be directly fostered through instruction in comprehension strategies. These sorts of discussions and activities should be conducted throughout a range of literacy genres, both fiction and nonfiction, and should be a regular component of the language arts curriculum throughout the children's school years.

OTHER FACTORS THAT INFLUENCE LEARNING TO READ

Our research continues to converge on the following findings. Good readers are phonemically aware and understand the alphabetic principle and can apply these skills to the development and application of phonics skills when reading words, and can accomplish these applications in a fluent and accurate manner. Given the ability to rapidly and automatically decode and recognize words, good readers bring strong vocabularies and good syntactic and grammatical skills to the reading comprehension process, and actively relate what is being read to their own background knowledge via a variety of strategies. But what factors can provide a firm foundation for these skills to develop?

It is clear from research on emerging literacy that learning to read is a relatively lengthy process that begins very early in development and clearly before children enter formal schooling. Children who receive stimulating literacy experiences from birth onward appear to have an edge when it comes to vocabulary development, an understanding of the goals of reading, and an awareness of print and literacy concepts. Children who are read to frequently at very young ages become exposed in interesting and exciting ways to the sounds of our language, to the concept of rhyming, and to other word and language play that serves to provide the foundation for the development of phoneme awareness. As children are exposed to literacy activities at young ages, they begin to recognize and discriminate letters. Without a doubt, children who have learned to recognize and print most letters as preschoolers will have less to learn upon school entry. The learning of letter names is also important because the names of many letters contain the sounds they most often represent, thus orienting youngsters early to the alphabetic principle or how letters and sounds connect. Ultimately, children's ability to understand what they are reading is inextricably linked to their background knowledge. Very young children who are provided opportunities to learn, think, and talk about new areas of knowledge will gain much from the reading process. With understanding comes the clear desire to read more and to read frequently, ensuring that reading practice takes place.

WHY DO SOME CHILDREN (AND ADULTS) HAVE DIFFICULTIES LEARNING TO READ?

Difficulties learning to read result from a combination of factors. In general, children who are most at-risk for reading failure are those who enter school with limited exposure to language and who have little prior understanding of concepts related to phonemic sensitivity, letter knowledge, print awareness, the purposes of reading, and general verbal skills, including vocabulary. Children raised in poverty, youngsters with limited proficiency in English, children with speech and hearing impairments, and children from homes where the parent's reading levels are low are relatively predisposed to reading failure. Likewise, youngsters with subaverage intellectual capabilities have difficulties learning to read, particularly in the reading comprehension domain.

Given this general background, recent research has been able to identify and replicate findings which point to at least four factors that hinder reading development among children irrespective of their socioeconomic level and ethnicity. These four factors include deficits in phoneme awareness and the development of the alphabetic principle (and the accurate and fluent application of these skills to textual reading), deficits in acquiring reading comprehension strategies and applying them to the reading of text, the development and maintenance of motivation to learn to read, and the inadequate preparation of teachers.

DEFICITS IN PHONEME AWARENESS AND THE DEVELOPMENT OF THE ALPHABETIC PRINCIPLE

In essence, children who have difficulties learning to read can be readily observed. The signs of such difficulty are: a labored approach to decoding or "sounding" unknown or unfamiliar words and repeated misidentification of known words. Reading is hesitant and characterized by frequent starts and stops and multiple mispronunciations. If asked about the meaning of what has been read, the child frequently has little to say. Not because he or she is not smart enough; in fact, many youngsters who have difficulty learning to read are bright and motivated to learn to read - at least initially. Their poor comprehension occurs because they take far too long to read the words, leaving little energy for remembering and understanding what they have read.

Unfortunately, there is no way to bypass this decoding and word recognition stage of reading. A deficiency in these skills cannot be appreciably offset by using context to figure out the pronunciation of unknown words. In essence, while one learns to read for the fundamental purpose of deriving meaning from print, the key to comprehension starts with the immediate and accurate reading of words. In fact, difficulties in decoding and word recognition are at the core of most reading difficulties. To be sure, there are some children who can read words accurately and quickly yet do have difficulties comprehending, but they constitute a small portion of those with reading problems.

If the ability to gain meaning from print is dependent upon fast, accurate, and automatic decoding and word recognition, what factors hinder the acquisition of these basic reading skills? As mentioned above, young children who have a limited exposure to both oral language and print before they enter school are at-risk for reading failure. However, many children with robust oral language experience, average to above intelligence and frequent interactions with books since infancy show surprising difficulties learning to read. Why?

In contrast to good readers who understand that segmented units of speech can be linked to letters and letter patterns, poor readers have substantial difficulty developing this "alphabetic principle". The culprit appears to be a deficit in phoneme awareness - the understanding that words are made up of sound segments called phonemes. Difficulties in developing phoneme awareness can have genetic and neurobiological origins or can be attributable to a lack of exposure to language patterns and usage during the preschool years. The end result is the same however. Children who lack phoneme awareness have difficulties linking speech sounds to letters - their decoding skills are labored and weak, resulting in extremely slow reading. This labored access to print renders comprehension impossible. Thus the purpose for reading is nullified because the children are too dysfluent to make sense out of what they read.

In studying approximately 34,501 thousand children over the past 33 years, we have learned the following with respect to the role that phonemic awareness plays in the development of phonics skills and fluent and automatic word reading:

1. Phonemic awareness skills assessed in kindergarten and first grade serve as potent predictors of difficulties learning to read. We have learned how to measure phonemic awareness skills as early as the first semester in kindergarten with tasks that take only 15 minutes to administer - and over the past decade we have refined these tasks so that we can predict with approximately 80% to 90% accuracy who become good readers and who will have difficulties learning to read.

2. We have learned that the development of phonemic awareness is a necessary but not sufficient condition for learning to read. A child must integrate phonemic skills into the learning of phonics principles, must practice reading so that word recognition becomes rapid and accurate, and must learn how to actively use comprehension strategies to enhance meaning.

3. We have begun to understand how genetics are involved in learning to read, and this knowledge may ultimately contribute to our prevention efforts through the assessment of family reading histories.

4. We are entering very exciting frontiers in understanding how early brain development can provide a window on how reading develops. Likewise, we are conducting studies to help us understand how specific teaching methods change reading behavior and how the brain changes as reading develops.

5. We have learned that just as many girls as boys have difficulties learning to read. Until five years ago, the conventional wisdom was that many more boys than girls had such difficulties. Now females should have equal access to screening and intervention programs.

6. We have learned that for 90% to 95% of poor readers, prevention and early intervention programs that combine instruction in phoneme awareness, phonics, fluency development, and reading comprehension strategies, provided by well trained teachers, can increase reading skills to average reading levels. However, we have also learned that if we delay intervention until nine-years-of-age, (the time that most children with reading difficulties receive services), approximately 75% of the children will continue to have difficulties learning to read throughout high school. To be clear, while older children and adults can be taught to read, the time and expense of doing so is enormous.

DEFICITS IN ACQUIRING READING COMPREHENSION STRATEGIES

Some children encounter obstacles in learning to read because they do not derive meaning from the material that they read. In the later grades, higher order comprehension skills become paramount for learning. Reading comprehension places significant demands on language comprehension and general verbal abilities. Constraints in these areas will typically limit comprehension. In a more specific vein, deficits in reading comprehension are related to:

(1) inadequate understanding of the words used in the text;

(2) inadequate background knowledge about the domains represented in the text;

(3) a lack of familiarity with the semantic and syntactic structures that can help to predict the relationships between words;

(4) a lack of knowledge about different writing conventions that are used to achieve different purposes via text (humor, explanation, dialogue, etc.);

(5) verbal reasoning ability which enables the reader to "read between the lines"; and

(6) the ability to remember verbal information.

If children are not provided early and consistent experiences that are explicitly designed to foster vocabulary development, background knowledge, the ability to detect and comprehend relationships among verbal concepts, and the ability to actively employ strategies to ensure understanding and retention of material, reading failure will occur no matter how robust word recognition skills are.

Our current understanding of how to develop many of these critical language and reasoning capabilities related to reading comprehension is not as well developed as the information related to phoneme awareness, phonics, and reading fluency. We have not yet obtained clear answers with respect to why some children have a difficult time learning vocabulary and how to improve vocabulary skills. Our knowledge about the causes and consequences of deficits in syntactical development is sparse. A good deal of excellent research has been conducted on the application of reading comprehension strategies, but our knowledge of how to teach children to apply these strategies in an independent manner and across contexts is just emerging.

THE DEVELOPMENT AND MAINTENANCE OF MOTIVATION TO LEARN TO READ

A major factor that aids or limits the amount of improvement that a child may make in reading is highly related to their motivation to persist in learning to read despite difficulties. Very little is known with respect to the exact timing and course of motivational problems in reading development, but it is clear that reading failure has a devastating effect on children. In the primary grades, reading activities constitute the major portion of academic activities undertaken in classrooms, and children who struggle with reading are quickly noticed by peers and teachers. Although most children enter formal schooling with positive attitudes and expectations for success, those who encounter difficulties learning to read clearly attempt to avoid engaging in reading behavior as early as the middle of the first grade year. It is known that successful reading development is predicated on practice in reading, and obviously the less a child practices, the less developed the various reading skills will become.

To counter these highly predicable declines in the motivation to learn to read, prevention and early intervention programs are critical.

INADEQUATE PREPARATION OF TEACHERS

As evidence mounts that reading difficulties originate in large part from difficulties in developing phoneme awareness, phonics, reading fluency, and reading comprehension strategies, the need for informed instruction for the millions of children with insufficient reading skills is an increasingly urgent problem. Unfortunately, several recent studies and surveys of teacher knowledge about reading development and difficulties indicate that many teachers are under prepared to teach reading. Most teachers receive little formal instruction in reading development and disorders during either undergraduate and/or graduate studies, with the average teacher completing only two reading courses. Surveys of teachers taking these courses indicate:

(A) teachers rarely have the opportunity to observe professors demonstrate instructional reading methods with children;

(B) course work is superficial and typically unrelated to teaching practice; and

(C) the supervision of student teaching and practicum experiences is fragmentary and inconsistent. At present, motivated teachers are often left to obtain specific skills in teaching phonemic awareness, phonics, reading fluency, and comprehension on their own by seeking out workshops or specialized instructional manuals.

Teachers who instruct youngsters who display reading difficulties must be well versed in understanding the conditions that have to be present for children to develop robust reading skills. They also must be thoroughly trained to assess and identify children at-risk for reading failure at early ages. Unfortunately, many teachers and administrators have been caught between conflicting schools of though about how to teach reading and how to help students who are not progressing easily. In reading education, teachers are frequently presented with a "One Size Fits All" philosophy that emphasizes either a "whole language" or "phonics" orientation to instruction. No doubt, this parochial type of preparation places many children at continued risk for reading failure since it is well established that no reading program should be without all the major components of reading instruction (phoneme awareness, phonics, fluency, reading comprehension) and the real question is which children need what, how, for how long, with what type of teacher, and in what type of setting.

It is hard to find disagreement in the educational community that the direction and fabric of teacher education programs in language arts and reading must change. However, bringing about such change will be difficult. In addition, if teacher preparation in the area of language and reading is expected to become more thoughtful and systematic, changes in how teaching competencies and certification requirements are developed and implemented is a must. Currently, in many states, the certification offices within state departments of education do not maintain formal and collaborative relationships with academic departments within colleges of education. Thus, the requirements that a student may be expected to satisfy for a college degree may bear little relationship to the requirements for a teaching certificate. More alarming is the fact that both university and state department of education requirements for the teaching of reading may not reflect, in any way, the type and depth of knowledge that teachers must have to ensure literacy for all.

FOR WHICH CHILDREN ARE WHICH TEACHING APPROACHES MOST BENEFICIAL AT WHICH STAGES OF READING DEVELOPMENT?

1. Learning to read is a lengthy and difficult process for many children, and success in learning to read is based in large part on developing language and literacy-related skills very early in life. A massive effort needs to be undertaken to inform parents, and the educational and medical communities of the need to involve children in reading from the first days of life - to engage children in playing with language through nursery rhymes, storybooks, and writing activities. To bring to children as early as possible experiences that help them understand the purposes of reading, and the wonder and joy that can be derived from reading. Parents must become intimately aware of the importance of vocabulary development and the use of verbal interactions with their youngsters to enhance grammar, syntax, and verbal reasoning.

2. Young preschool children should be encouraged to learn the letters of the alphabet, to discriminate letters from one another, to print letters, and to attempt to spell words that they hear. By introducing young children to print, their exposure to the purposes of reading and writing will increase and their knowledge of the conventions of print and their awareness of print concepts will increase.

3. Reading out loud to children is a proven activity for developing vocabulary growth and language expansion and plays a causal role in developing both receptive and expressive language capabilities. Reading out loud can also be used to enhance children's background knowledge of new concepts that may appear in both oral and written language.

4. Our NICHD prevention and early intervention studies in Houston, Tallahassee, Albany, Syracuse, Atlanta, Boston, Seattle, and Washington, D.C. all speak to the importance of early identification and intervention with children at-risk for reading failure. Procedures now exist to identify such children with good accuracy. This information needs to be widely disseminated to schools, teachers, and parents.

5. Kindergarten programs should be designed so that all children will develop the prerequisite phonological, vocabulary, and early reading skills necessary for success in the first grade. All children should acquire the ability to recognize and print both upper and lowercase letters with reasonable ease and accuracy, develop familiarity with the basic purposes and mechanisms of reading and writing, and develop age-appropriate language comprehension skills.

6. Beginning reading programs should be constructed to ensure that adequate instructional time is allotted to the teaching of phonemic awareness skills, phonics skills, the development of reading fluency and automaticity, and the development of reading comprehension strategies. All of these components of reading are necessary but not sufficient in and of themselves. For children demonstrating difficulty in learning to read, it is imperative that each of these components be taught within an integrated context and that ample practice in reading familiar material be afforded. For some children, our research demonstrates that explicit, systematic instruction is crucial in helping them to understand and apply critical phonemic, phonics, fluency, and reading comprehension skills. Even for children who seem to grasp reading concepts easily, learning to read is not a natural process - reading instruction must be thoughtful, planned, and must incorporate the teaching of all the critical reading skills.

7. A major impediment to serving the needs of children demonstrating difficulties learning to read is current teacher preparation practices. Many teachers lack basic knowledge about the structure of the English language, reading development, and the nature of reading difficulties. Major efforts should be undertaken to ensure that colleges of education possess the expertise and commitment to foster expertise in teachers at both preservice and in service levels.

8. The preparation of teachers and the teaching of reading in our nation's classrooms must be based upon research evidence of the highest caliber and relevance. Research that is used to guide policy and instructional practice should be characterized by methodological rigor and the convergence of studies demonstrated to be representative, reliable, valid and

> described with sufficient clarity and specificity to permit independent replication. Moreover, we must realize that no one study or type of research methodology can be used to guide practice. To reiterate a significant point, the research knowledge that is employed to guide policy and practice must inform us how different components of reading behavior are best developed by various approaches to reading instruction for children of differing backgrounds, learning characteristics, and literacy experiences.

In short, both the provision of quality reading instruction to our nation's children and the preparation of teachers are critically dependent upon the development of a body of knowledge about reading development, reading instruction, and reading difficulties that reflects the tremendous developmental complexity inherent in the study of individual differences and the substantial contextual complexity inherent in studying children, teachers, and student-teacher interactions in classrooms. For too long, the educational enterprise in this country has gravitated toward a "one-size-fits-all" solution to both research methods and classroom teaching practices.

For example debates persist about the merits of conducting quantitative research studies versus qualitative/descriptive research studies. Likewise, the debate about code-based instruction versus whole language (literature-based) instruction continues to distract and confuse. Why such parochial and superficial discussions continue to drive current trends in research, teacher preparation, and classroom reading instruction is beyond my analytic capability, but I do know that we have to begin to invest more and invest differently in our research infrastructure if we are to ever understand the complexity of reading development and optimal ways to provide reading instruction.

There is no doubt that the research of the future must combine research strategies that are experimentally responsible, test specific well defined ideas, yield data that are reliable, and are described sufficiently to permit replication, with research methods that provide a qualitative, albeit reliable, view of the complexity and the process involved in imparting reading concepts to children of varying abilities in classrooms. The question is NOT whether quantitative, hypothesis-driven research methods are more powerful than descriptive methodologies embodied in ethnographic studies, case histories, or classroom observation studies. The question we must ask and answer is WHICH COMBINATIONS OF RESEARCH METHODS AND APPROACHES ARE MOST APPROPRIATE FOR WHICH SPECIFIC RESEARCH QUESTIONS. Likewise, instructional questions that reflect an either-or phonics/whole language reading program choice must be replaced by questions that embrace the complexity of reading instruction. For example, FOR WHICH CHILDREN, ARE WHICH READING INSTRUCTION MODELS/ APPROACHES/METHODS MOST BENEFICIAL AT WHICH STAGES OF READING DEVELOPMENT AND IN WHICH CLASSROOM ENVIRONMENTS.

To answer these questions, our research efforts must include longitudinal studies to capture the changes over time that our children will demonstrate during instruction and that will provide us with an appropriate window on instructional issues related to intensity, duration, timing of different approaches, and contextual-decontextual influences on the development of critical reading behaviors. The investment in our research efforts must certainly be commensurate with the cost of conducting multi-method, multi-level, multi-trait longitudinal studies that have the capability of accounting for the multiple interacting factors that comprise the learning to read process.

Thank you for your time.

NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

NATIONAL INSTITUTES OF HEALTH

Statement by G. Reid Lyon, Ph.D.

Chief, Child Development and Behavior Branch

National Institute of Child Health and Human Development

On

HEARING ON LITERACY: WHY KIDS CAN'T READ

For

Committee on Education and the Workforce

U.S. House of Representatives

Washington, DC

July 10, 1977

Mr. Chairman and members of the Committee, I am Dr. Reid Lyon, the Chief of the Child Development and Behavior Branch of the National Institute of Child Health and Human Development (NICHD) at the National Institutes of Health (NIH). I am pleased to have the opportunity to present to you information about the results of the extensive research that our Institute has supported on the process of learning to read in our Nation's schools.

The psychological, social, and economic consequences of reading failure are legion. It is for this reason that the NICHD considers reading failure to reflect not only an educational problem, but a significant public health problem as well. Within this context, a large, well coordinated network consisting of 18 NICHD-supported research sites across the country has been working extremely hard to understand:

(1) the critical environmental, experiential, cognitive, genetic neurobiological, and instructional conditions that foster strong reading development;

(2) the risk factors that predispose youngsters to reading failure; and

(3) the instructional procedures that can be applied to ameliorate reading deficits at the earliest possible time. In some cases, these NICHD studies have been continuously ongoing since 1965. The majority, however, were initiated in the early and mid-1980's with youngsters at five years of age and have studied these children longitudinally over the succeeding years. At one NICHD research site, the children are now young adults (21 years of age), with other sites following cohorts that span from elementary grade through middle and high school

Mr. Chairman and members of the committee, some children learn to read and write with ease. Even before they enter school, they have developed an understanding that the letters on a page can be sounded out to make words and some preschool children can even read words correctly that they have never seen before and comprehend what they have read. As Marilyn Adams has reported, before school, and without any great effort or pressure on the part of their parents, they pick up books, pencils, and paper, and they are on their way, almost as though by magic.

However, the magic of this effortless journey into the world of reading is available to only about 5% of our nation's children. It is suggested in the research literature that another 20% to 30% learn to read relatively easily once exposed to formal instruction, and it seems that youngsters in this group learn to read in any classroom, with any instructional emphasis.

Unfortunately, it appears that for about 60% of our nation's children, learning to read is a much more formidable challenge, and for at least 20% to 30% of these youngsters, reading is one of the most difficult tasks that they will have to master throughout their schooling. Why is this so unfortunate? Simply because if you do not learn to read and you live in America, you do not make it in life. Consider that reading skill serves as the major avenue to learning about other people, about history and social studies, the language arts, science, mathematics, and the other content subjects that must be mastered in school. When children do not learn to read, their general knowledge, their spelling and writing abilities, and their vocabulary development suffers in kind. Within this context, reading skill serves as the major foundational skill for all school-based learning, and without it, the chances for academic and occupational success are limited indeed. Because of its importance and visibility, particularly during the primary grades, difficulty learning to read squashes the excitement and love for learning that many youngsters enter school with. It is embarrassing and even devastating to read slowly and laboriously and to demonstrate this weakness in front of peers on a daily basis. It is clear from our NICHD-supported longitudinal studies that follow good and poor readers from kindergarten into young adulthood that our young poor readers are not used to such failure. By the end of the first grade, we begin to notice substantial decreases in the children's self-esteem, self-concept, and motivation to learn to read if they have not been able to master reading skills and keep up with their age-mates. As we follow the children through elementary and middle school grades these problems compound, and, in many cases very bright youngsters are unable to learn about the wonders of science, mathematics, literature and the like because they can not read the grade-level textbooks. By high school, these children's potential for entering college has decreased to almost nil, with few choices available to them with respect to occupational and vocational opportunities. These individuals constantly tell us that they hate to read, primarily because it is such hard work, and their reading is so slow and laborious. As one adolescent in one of our longitudinal studies remarked recently, "I would rather have a root canal than read".

While failure to learn to read adequately is much more likely among poor children, among nonwhite children, and among nonnative speakers of English, recent data derived from the National Assessment of Educational Progress (1994) reveals an alarming trend. In the State of California, 59% of fourth grade children had little or no mastery of the knowledge and skills necessary to perform reading activities at the fourth grade level, compared to a national average of 44% below basic reading levels. Even more alarming, is that this evidence of serious reading failure cuts across all ethnic and socioeconomic variables. While 71% of African-Americans, 81% of Hispanics and 23% of Asians were reading below basic levels, 44% of white students in the fourth grade were also below the basic reading level necessary to use reading as a skill. Moreover, 49% of the fourth grade children in California who were reading below basic levels were from homes where the parents had graduated from college. In fact, the children of college-educated parents in California scored lowest with respect to their national cohort.

These data underscore the fact that reading failure is a serious National problem and cannot simply be attributed to poverty, immigration, or the learning of English as a second language. The psychological, social, and economic consequences of reading failure are legion. It is for this reason that the National Institute of Child Health and Human Development (NICHD) within the National Institutes of Health (NIH) considers reading failure to reflect not only an educational problem, but a significant public health problem as well. Within this context, a large, well coordinated network consisting of 18 research sites across the country has been working extremely hard to understand

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With this as background, my remaining testimony will focus on addressing several major questions of interest to the Committee on Education and the Workforce hearing on Literacy. These questions are:

1) How Do Children Learn To Read?

2) Why Are So Many Children Having Difficulty Learning to Read?

3) How Can We Help Children Learn to Read?

HOW DO CHILDREN LEARN TO READ?

UNDERSTANDING HOW SOUNDS ARE CONNECTED TO PRINT

In general, learning to read the English language is not as easy as conventional wisdom would suggest. Every type of writing system whether it be a syllabic system as used by the Japanese, a morphosyllabic system as used by the Chinese (where a written symbol represents a unit of meaning), or an alphabetic system that is used in English, Spanish, and Scandinavian languages (to name a few) present challenges to the beginning reader. In contrast to learning to read English, learning the Japanese or Chinese writing systems may initially be easier because the written units represent real and meaningful verbal concepts. In contrast, in an English alphabetic system, the individual letters on the page are abstract and meaningless, in and of themselves. They must eventually be linked to equally abstract sounds, called phonemes, blended together, and pronounced as words, where meaning is finally realized. To learn to read English, the child must figure out the relationship between sounds and letters. Thus, the beginning reader must learn the connections between the 40 or so sounds of spoken English (the phonemes), and the 26 letters of the alphabet. What our NICHD research has taught us is that in order for a beginning reader to learn how to connect or translate printed symbols (letters and letter patterns) into sound, the would-be reader must understand that our speech can be segmented or broken into small sounds (phoneme awareness) and that the segmented units of speech can be represented by printed forms (Phonics). This understanding that written spellings systematically represent the phonemes of spoken words (termed the alphabetic principle) is absolutely necessary for the development of accurate and rapid word reading skills.

Why is phoneme awareness so critical for the beginning reader? Because if children cannot perceive the sounds in spoken words - for example, if they cannot "hear" the "at" sound in "fat" and "cat" and perceive that the difference lies in the first sound - they will have difficulty decoding or "sounding out" words in a rapid and accurate fashion. This awareness of the sound structure of our language seems so easy and commonplace that we take it for granted. But many children do not develop phoneme awareness, and for some interesting reasons that we are now beginning to understand. Unlike writing, the speech we use to communicate orally does not consist of separate sounds in words. For example, while a written word like "cat" has three letter-sound units, the ear hears only one sound, not three, when the word "cat" is spoken aloud. This merging and overlapping of sounds into a sound "bundle" makes oral communication much more efficient. Consider how long it would take to have a conversation if each of the words that we uttered were segmented or "chopped" into their sound structure. In essence we would be spelling aloud the words that we were speaking. From the NICHD studies that were actually initiated in 1965 to understand how the reading process develops, we now have strong evidence that it is not the ear that understand that a spoken word like "cat" is divided into three sounds and that these discrete sounds can be linked to the letters C-A-T, it is the brain that performs this function. In some youngsters, the brain seems to have an easy time processing this type of information. However, in many children, the skill is only learned with difficulty, and thus must be taught directly, explicitly, and by an informed teacher. It has also become clear to us that the development of these critical early reading-related skills such as phoneme awareness and phonics are fostered when children are read to at home during the preschool years, when they learn their letter and number names, and when they are introduced at very early ages to concepts of print and literacy activities.

Does this mean that children who have a difficulty understanding that spoken words are composed of discrete individual sounds that can be linked to letters suffer from brain dysfunction or damage? Not at all. It simply means that the neural systems that perceive the phonemes in our language are less efficient than in other children. This difference in neural efficiency can also be hypothesized to underlie the individual differences that we see every day in learning any skill such as singing, playing an instrument, constructing a house, painting a portrait, and the like. In some cases our NICHD studies have taught us that the phonological differences we see in good and poor readers have a genetic basis. In other children, the differences seem to be attributable to a lack of exposure to language patterns and literacy-based materials during the preschool years.

As pointed out, the development of phoneme awareness, the development of an understanding of the alphabetic principle, and the translation of these skills to the application of phonics in reading words are non-negotiable beginning reading skills that ALL children must master in order to understand what they read and to learn from their reading sessions. Printed letters and words are the basic data on which reading depends, and the emerging reader must be able to recognize with accuracy spelling patterns and their mappings to speech. To recapitulate, these skills are supported nicely when children receive an abundance of early literacy experiences in the home and in preschool. But the development of phoneme awareness and phonics, while NECESSARY, are NOT SUFFICIENT, for learning to read the English language so that meaning can be derived from print. In addition to learning how to "sound out" new and/or unfamiliar words, the beginning reader must eventually become proficient in reading, at a very fast pace, larger units of print such as syllable patterns, meaningful roots, suffixes, and whole words.

THE DEVELOPMENT OF READING FLUENCY

While the ability to read words accurately is a NECESSARY skill in learn to read, the speed at which this is done becomes a critical factor in ensuring that children understand what they read. As one child recently remarked, "if you don't ride a bike fast enough, you fall off". Likewise, if the reader does not recognize words quickly enough, the meaning will be lost. Although the initial stages of reading for many students requires the sequential learning of phoneme awareness and phonics principles, substantial practice of those skills, and continual application of those skills, fluency and automaticity in decoding and word recognition must be acquired as well. Consider that a young reader (and even older readers for that matter) has only so much attentional capacity and cognitive energy to devote to a particular task. If the reading of the words on the page is slow and labored, the reader simply cannot remember what they have read, much less relate the ideas they have read about to their own background knowledge. Children vary in the amount of practice that is required for fluency and automaticity in reading to occur. Some youngsters can read a word only once to recognize it again with greater speed; others need more than 20 or more exposures. The average child needs between four and 14 exposures to automatize the recognition of a new word. Therefore, in learning to read, it is vital that children read a large amount of text at their independent reading level (95% accuracy), and that the text provide specific practice in the skills being learned.

CONSTRUCTING MEANING FROM PRINT

The ultimate goal of reading instruction is to enable children to understand what they read. Again, the development of phoneme awareness, phonics skills, and the ability to read words fluently and automatically are NECESSARY but NOT SUFFICIENT for the construction of meaning from text. The ability to understand what is read appears to be based on several factors. Children who comprehend well, seem to be able to activate their relevant background knowledge when reading - that is, they can relate what is on the page to what they already know. Good comprehenders also have good vocabularies, since it is extremely difficult to understand something you cannot define. Good comprehenders also have a knack for summarizing, predicting, and clarifying what they have read, and frequently use questions to guide their understanding. Good comprehenders are also facile in employing the sentence structure within the text to enhance their comprehension.

In general, if children can read the words on a page accurately and fluently, they will be able to construct meaning at two levels. At the first level, literal understanding is achieved. However, constructing meaning requires far more than literal comprehension. Child must eventually guide themselves through text by asking questions like. "Why am I reading this and how does this information relate to my reasons for doing so?", "What is the author's point of view?", "Do I understand what the author is saying and why?", "Is the text internally consistent?", and so on. It is this second level of comprehension that leads readers to reflective, purposeful understanding.

The development of reading comprehension skills, like the development of phoneme awareness, phonics, and fluency, needs to be fostered by highly trained teachers. Recent research shows that the teacher must arrange for opportunities for students to discuss the highlights of what they have read and any difficulties they have had when reading. Because the grammatical structures of written text are more varied and complex than those of casual, oral language (speaking to one another), regular exploration and explicit instruction on formal syntax is warranted. Children's reflections on what they have read can also be directly fostered through instruction in comprehension strategies. These sorts of discussions and activities should be conducted throughout a range of literacy genres, both fiction and nonfiction, and should be a regular component of the language arts curriculum throughout the children's school years.

OTHER FACTORS THAT INFLUENCE LEARNING TO READ

Our research continues to converge on the following findings. Good readers are phonemically aware and understand the alphabetic principle and can apply these skills to the development and application of phonics skills when reading words, and can accomplish these applications in a fluent and accurate manner. Given the ability to rapidly and automatically decode and recognize words, good readers bring strong vocabularies and good syntactic and grammatical skills to the reading comprehension process, and actively relate what is being read to their own background knowledge via a variety of strategies. But what factors can provide a firm foundation for these skills to develop?

It is clear from research on emerging literacy that learning to read is a relatively lengthy process that begins very early in development and clearly before children enter formal schooling. Children who receive stimulating literacy experiences from birth onward appear to have an edge when it comes to vocabulary development, an understanding of the goals of reading, and an awareness of print and literacy concepts. Children who are read to frequently at very young ages become exposed in interesting and exciting ways to the sounds of our language, to the concept of rhyming, and to other word and language play that serves to provide the foundation for the development of phoneme awareness. As children are exposed to literacy activities at young ages, they begin to recognize and discriminate letters. Without a doubt, children who have learned to recognize and print most letters as preschoolers will have less to learn upon school entry. The learning of letter names is also important because the names of many letters contain the sounds they most often represent, thus orienting youngsters early to the alphabetic principle or how letters and sounds connect. Ultimately, children's ability to understand what they are reading is inextricably linked to their background knowledge. Very young children who are provided opportunities to learn, think, and talk about new areas of knowledge will gain much from the reading process. With understanding comes the clear desire to read more and to read frequently, ensuring that reading practice takes place.

WHY ARE SO MANY CHILDREN HAVING DIFFICULTIES LEARNING TO READ?

Difficulties learning to read result from a combination of factors. In general, children who are most at-risk for reading failure are those who enter school with limited exposure to language and thus less prior knowledge of concepts related to phonemic sensitivity, letter knowledge, print awareness, the purposes of reading, and general verbal skills, including vocabulary. Children raised in poverty, youngsters with limited proficiency in English, children with speech and hearing impairments, and children from homes where the parent's reading levels are low are clearly predisposed to reading failure. Likewise, youngsters with subaverage intellectual capabilities have difficulties learning to read.

Given this general background, recent research has been able to identify and replicate findings which point to at least four factors that hinder reading development among children irrespective of their socioeconomic level and ethnicity. These four factors include deficits in phoneme awareness and the development of the alphabetic principle, deficits in acquiring reading comprehension strategies and applying them to the reading of text, the development and maintenance of motivation to learn to read, and the inadequate preparation of teachers.

DEFICITS IN PHONEME AWARENESS AND THE DEVELOPMENT OF THE ALPHABETIC PRINCIPLE

In essence, children who have difficulties learning to read can be readily observed. The signs of such difficulty are: a labored approach to decoding or "sounding" unknown or unfamiliar words and repeated misidentification of known words. Reading is hesitant and characterized by frequent starts and stops and multiple mispronunciations. If asked about the meaning of what has been read, the child frequently has little to say. Not because he or she is not smart enough; in fact, many youngsters who have difficulty learning to read are bright and motivated to learn to read - at least initially. Their poor comprehension occurs because they take far too long to read the words, leaving little energy for remembering and understanding what they have read.

Unfortunately, there is no way to bypass this decoding and word recognition stage of reading. A deficiency in these skills cannot be appreciably offset by using context to figure out the pronunciation of unknown words. In essence, while one learns to read for the fundamental purpose of deriving meaning from print, the key to comprehension starts with the immediate and accurate reading of words. In fact, difficulties in decoding and word recognition are at the core of most reading difficulties. To be sure, there are some children who can read words accurately and quickly yet do have difficulties comprehending, but they constitute a small portion of those with reading problems.

If the ability to gain meaning from print is dependent upon fast, accurate, and automatic decoding and word recognition, what factors hinder the acquisition of these basic reading skills? As mentioned above, young children who have a limited exposure to both oral language and print before they enter school are at-risk for reading failure. However, many children with robust oral language experience, average to above intelligence and frequent interactions with books since infancy show surprising difficulties learning to read. Why?

In contrast to good readers who understand that segmented units of speech can be linked to letters and letter patterns, poor readers have substantial difficulty in developing this "alphabetic principle". The culprit appears to be a deficit in phoneme awareness - the understanding that words are made up of sound segments called phonemes. Difficulties in developing phoneme awareness can have genetic and neurobiological origins or can be attributable to a lack of exposure to language patterns and usage during the preschool years. The end result is the same however. Children who lack phoneme awareness have difficulties linking speech sounds to letters - their decoding skills are labored and weak, resulting in extremely slow reading. As mentioned this labored access to print renders comprehension impossible. Thus the purpose for reading is nullified because the children are too dysfluent to make sense out of what they read.

In studying approximately 10 thousand children over the past 15 years, we have learned the following with respect to the role that phonemic awareness plays in the development of phonics skills and fluent and automatic word reading:

1. Phonemic awareness skills assessed in kindergarten and first grade serve as potent predictors of difficulties learning to read. We have learned how to measure phonemic awareness skills as early as the first semester in kindergarten with tests that take only 15 minutes to administer - and over the past decade we have refined these tasks so that we can predict with approximately 92% accuracy who will have difficulties learning to read.

2. We have learned that the average cost of assessing each child during kindergarten or first grade with experimental predictive measures is approximately $10 to $15. This cost estimate includes the costs of these experimental assessment materials.

3. We have learned that the development of phonemic awareness is a necessary but not sufficient condition for learning to read. A child must integrate phonemic skills into the learning of phonics principles, must practice reading so that word recognition is rapid and accurate, and must learn how to actively use comprehension strategies to enhance meaning.

4. We have begun to understand how genetics are involved in learning to read, and this knowledge may ultimately contribute to our prevention effort through the assessment of family reading histories.

5. We are entering very exciting frontiers in understanding how early brain development can provide a window on how reading develops. Likewise, we are conducting studies to help us understand how specific teaching methods change reading behavior and how the brain changes as reading develops.

6. We have learned that just as many girls as boys have difficulties learning to read. Until five years ago, the conventional wisdom was that many more boys than girls had such difficulties. Now females should have equal access to screening and intervention programs.

7. We have learned that for 90% to 95% of poor readers, prevention and early intervention programs that combine instruction in phoneme awareness, phonics, and reading comprehension strategies provided by well trained teachers can increase reading skills to average reading levels. However, we have also learned that if we delay early intervention until nine-years-of-age, (the time that most children with reading difficulties receive services), approximately 75% of the children will continue to have difficulties learning to

read throughout high school. To be clear, while older children and adults can be taught to read, the time and expense of doing so is enormous.

DEFICITS IN ACQUIRING READING COMPREHENSION STRATEGIES

Some children encounter obstacles in learning to read because they do not derive meaning from the material that they read. In the higher grades, higher order comprehension skills become paramount for learning. Reading comprehension places significant demands on language comprehension and general verbal abilities. Constraints in these areas will typically limit comprehension. In a more specific vein, deficits in reading comprehension are related to:

(1) inadequate understanding of the words used in the text;

(2) inadequate background knowledge about the domains represented in the text;

(3) a lack of familiarity with the semantic and syntactic structures that can help to predict the relationships between words;

(4) a lack of knowledge about different writing conventions that are used to achieve different purposes via text (humor, explanation, dialogue, etc.);

(5) verbal reasoning ability which enables the reader to "read between the lines"; and

(6) the ability to remember verbal information.

If children are not provided early and consistent experiences that are explicitly designed to foster vocabulary development, background knowledge, the ability to detect and comprehend relationships among verbal concepts, and the ability to actively employ strategies to ensure understanding and retention of material, reading failure will occur no matter how robust word recognition skills are.

Our current understanding of how to develop many of these critical language and reasoning capabilities related to reading comprehension is not as well developed as the information related to phoneme awareness, phonics, and reading fluency. We have not yet obtained clear answers with respect to why some children have a difficult time learning vocabulary and how to improve vocabulary skills. Our knowledge about the causes and consequences of deficits in syntactical development is sparse. A good deal of excellent research has been conducted on the application of reading comprehension strategies, but our knowledge of how to help children use these strategies in an independent manner and across contexts is just emerging.

THE DEVELOPMENT AND MAINTENANCE OF MOTIVATION TO LEARN TO READ

A major factor that limits the amount of improvement that a child may make in reading is related to the motivation to continue the learning process. Very little is known with respect to the exact timing and course of motivational problems in the learning to read process, but it is difficulties learning to read are very demoralizing to children. In the primary grades, reading activities constitute the major portion of academic activities undertaken in classrooms, and children who struggle with reading are quickly noticed by peers and teachers. Although most children enter formal schooling with positive attitudes and expectations for success, those who encounter difficulties learning to read clearly attempt to avoid engaging in reading behavior as early as the middle of the first grade year. It is known that successful reading development is predicated on practice reading, and obviously the less a child practices, the less developed the various reading skills will become.

To counter these highly predicable declines in the motivation to learn to read, prevention and early intervention programs are critical.

INADEQUATE PREPARATION OF TEACHERS

As evidence mounts that reading difficulties originate in large part from difficulties in developing phoneme awareness, phonics, reading fluency, and reading comprehension strategies, the need for informed instruction for the millions of children with insufficient reading skills is an increasingly urgent problem. Unfortunately, several recent studies and surveys of teacher knowledge about reading development and difficulties indicate that many teachers are underprepared to teach reading. Most teachers receive little formal instruction in reading development and disorders during either undergraduate and/or graduate studies, with the average teacher completing only two reading courses. Surveys of teachers taking these courses indicates consistently that teachers have never observed professors demonstrate instructional reading methods with children, that course work is superficial and unrelated to teaching practice, and that the supervision of student teaching and practicum experiences is fragmentary and inconsistent. At present, motivated teachers are often left to obtain specific skills in teaching phonemic awareness, phonics, reading fluency, and comprehension on their own by seeking out workshops or specialized instructional manuals.

Clearly teachers who instruct youngsters who display reading difficulties must be well versed in understanding the conditions that must be present for children to develop robust reading skills, and must be thoroughly trained to assess and identify problem readers at early ages. Unfortunately, many teachers and administrators have been caught between conflicting schools of though about how to teach reading and how to help students who are not progressing easily. In reading education, teachers are frequently presented with a "One Size Fits All" philosophy that emphasizes either a "whole language" or "phonics" orientation to instruction. No doubt, this parochial type of preparation places many children at continued risk for reading failure since it is well established that no reading program should be without all the major components of reading instruction (phoneme awareness, phonics, fluency, reading comprehension) and the real question is which children need what, how, for how long, with what type of teacher, and in what type of setting.

It is hard to find disagreement in the educational community that the direction and fabric of teacher education programs in language arts and reading must change. However, bringing about such change will be difficult. In addition, if teacher preparation in the area of language and reading is expected to become more thoughtful and systematic, change in how teaching competencies and certification requirements are developed and implemented is a must. Currently, in many states, the certification offices within state departments of education do not maintain formal and collaborative relationships with academic departments within colleges of education. Thus, the requirements that a student may be expected to satisfy for a college degree may bear little relationship to the requirements for a teaching certificate. More alarming is the fact that both university and state department of education requirements for the teaching of reading may not reflect, in any way, the type and depth of knowledge that teachers must have to ensure literacy for all.

HOW CAN WE HELP CHILDREN LEARN TO READ?

1. Learning to read is a lengthy and difficult process for many children, and success in learning to read is based in large part on developing language and literacy-related skills very early in life. A massive effort needs to be undertaken to inform parents, and the educational and medical communities of the need involve children in reading from the first days of life - to engage children in playing with language through nursery rhymes,

storybooks, and writing activities. To bring to children as early as possible experiences that help them understand the purposes of reading, and the wonder and joy that can be derived from reading. Parents must become intimately aware of the importance of vocabulary development and the use of verbal interactions with their youngsters to enhance grammar, syntax, and verbal reasoning.

2. Young preschool children should be encouraged to learn the letters of the alphabet, to discriminate letters from one another, to print letters, and to attempt to spell words that they hear. By introducing young children to print, their exposure to the purposes of reading and writing will increase and their knowledge of the conventions of print and their awareness of print concepts will increase.

3. Reading out loud to children is a proven activity for developing vocabulary growth and language expansion and plays a causal role in developing both receptive and expressive language capabilities. Reading out loud can also be used to enhance children's background knowledge of new concepts that may appear in both oral and written language.

4. Our NICHD prevention and early intervention studies in Houston, Texas, Tallahassee, Florida, and Albany, New York all speak to the importance of early identification and intervention with children at-risk for reading failure. Procedures now exist to identify such children with good accuracy. This information needs to be widely disseminated to schools, teachers, and parents.

5. Kindergarten programs should be designed so that all children will develop the prerequisite phonological, vocabulary, and early reading skills necessary for success in the first grade. All children should acquire the ability to recognize and print both upper and lowercase letters with reasonable ease and accuracy, develop familiarity with the basic purposes and mechanisms of reading and writing, and develop age-appropriate language comprehension skills.

6. Beginning reading programs should be constructed to ensure that adequate instructional time be allotted to the teaching of phonemic awareness skills, phonics skills, the development of reading fluency and automaticity, and the development of reading comprehension strategies. All of these components of reading are necessary but not sufficient in and of themselves. For children demonstrating difficulty in learning to read, it is imperative that each of these components be taught within an integrated context and that ample practice in reading familiar material be afforded.

7. A major impediment to serving the needs of children demonstrating difficulties learning to read is current teacher preparation practices. Many teachers lack basic knowledge and understanding of reading development and the nature of reading difficulties. Major efforts should be undertaken to ensure that colleges of education possess the expertise and commitment to foster expertise in teachers at both preservice and in service levels.

8. Develop strong competency-based training programs with formal board certification for teachers of reading.

CURRICULUM VITA

G. REID LYON, PH.D.

February 2003

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CURRICULUM VITA

G. Reid Lyon, Ph.D.
Chief, Child Development and Behavior Branch
National Institute of Child Health and Human Development
National Institutes of Health

Date of Birth: January 7, 1949
Citizenship: U.S.
Veteran: Army: 1967-1970
Occupation Code: 0180/Psychologist

Work Address: Child Development and Behavior Branch
Center for Research for Mothers and Children
National Institute for Child Health and Human Development
6100 Executive Boulevard, Room 4B05; Bethesda, Maryland 20892; (301) 496-9849

Education

PhD Psychology and Special Education (Combined Doctoral Program) *December 1978*
University of New Mexico, Albuquerque
Concentrations: Neuropsychology and Learning Disabilities
Awarded with Distinction
Dissertation Honors
Dissertation Title: Neuropsychological Characteristics of Subgroups of Learning Disabled Readers

MA Educational Psychology and Special Education *August 1974*
University of New Mexico, Albuquerque
Concentrations: Psychometrics, Learning Theory, Neurophysiology

BA Experimental Psychology *December 1973*
North Carolina Wesleyan College
Summa Cum Laude

Professional Experience

Psychologist and Chief (Title 42) *May 1997 – present*
Child Development and Behavior Branch
Center for Research for Mothers and Children
National Institute of Child Health and Human Development
National Institutes of Health

Current Duties: Manages a research branch composed of scientific programs in (1) normative cognitive, social, and affective development; (2) developmental psychobiology and cognitive neuroscience; (3) behavioral pediatrics and health promotion research; (4) development and disorders in language, reading, and attention; (5) child abuse and neglect and family violence; (6) bilingual (Spanish/English) language and reading development; (7) early childhood development and school readiness; and, mathematics development and disabilities.

Supervises seven program directors (six PhD's, one MD), a varying number of research fellows and assistants, and three program assistants/secretaries.

Directs 44-site NICHD Reading Research Network (Annual Budget: $36 million). Administers $105 million annual Branch budget.

Provides Congressional testimony and scientific briefings to the White House on matters related to child development, learning disorders, and reading development and disorders.

Psychologist and Acting Chief (GS-15-6) *July 1996 - May 199*
Learning Disabilities, Cognitive, and Social Development Branch
Center for Research for Mothers and Children
National Institute of Child Health and Human Development
National Institutes of Health
Psychologist (0180) GS-14-10 Level (2/92-12/95) GS-15-6 Level (12/95-5/97) *February 1992 - July 199*
Human Learning and Behavior Branch
Center for Research for Mothers and Children
National Institute of Child Health and Human Development
National Institutes of Health
Associate Professor *September 1983 - February 199*
Department of Neurology
University of Vermont; Burlington, Vermont
Adjunct Associate Professor *September 1983 - August 199*
Department of Communication Science and Disorders
University of Vermont; Burlington, Vermont
Professor of Education and Psychology *September 1990 - February 199*
Johnson State College; Johnson, Vermont
Private Practice School Psychology and Neuropsychology *September 1983 - February 199*
Underhill Center; Vermont
Research Scientist and Visiting Professor *August 1988 - May 198*
Gundersen Medical Foundation; LaCrosse, Wisconsin

Director of Research and Training *September 1983 - May 198*
Center for Language and Learning; Burlington, Vermont

Consulting School Psychologist Consulting Neuropsychologist *August 1983 - June 199*
Chittendon East Supervisory Union; Richmond, Vermont

Assistant Professor and Director of the Neuropsychology Laboratory, *August 1980 - August 198*
Department of Communication Sciences and Disorders and Department of Neuroscience
Northwestern University; Evanston, Illinois

Assistant Professor and Director of the Educational Clinic *August 1978 - August 198*
Department of Special Education
University of Alabama; Birmingham, Alabama

Educational Psychologist *September 1976 - December 197*
Manzanita Center
University of New Mexico; Albuquerque, New Mexico

Classroom and Special Education Teacher *September 1975 - May 197*
Albuquerque Public Schools; Albuquerque, New Mexico

Psychologist *August 1974 - August 197*
O'Berry Center; Goldsboro, North Carolina

Other Professional Responsibilities

National Service

Advisor to President George W. Bush on Child Development and Education	*2000 - present*
Advisor to First Lady Laura Bush on Child Development Issues and Programs	*2000 - present*
Member, President's Commission on Excellence in Special Education	*2001 - 2002*
Consulting Scientist and Reviewer - NICHD, NIH	*1982 - 1991*
Member of Maternal and Child Health Research Committee (Study Section), NICHD, NIH	*1988 - 1992*
Expert Appointment to the NICHD in Developmental Neuropsychology	*1990*
Chairman, Scientific Review Committees (Study Section) for Learning Disabilities Research Centers and Program Projects, NICHD, NIH	*1988 - 1991*
Chairman, Research Committee, Division for Children with Learning Disabilities, Council for Exceptional Children	*1987 - 1990*
Advisory Board Member, National Center for Learning Disabilities	*1985 - 1994*
Advisory Board Member, National Center for Literacy	*1993 - present*
Advisory Board Member, Center for Development and Learning	*1998 - present*
AD Hoc Extramural Reviewer, NICHD and NINDS	*1981 - 1991*
Ad Hoc Extramural Reviewer, Office of Special Education Research	*1978 - 1982*
Ad Hoc Scientific Review Panel Member, National Science Foundation	*1985 - 1991*
Member - White House Council On Disability	*1995 - present*
Member - Interagency Educational Research Initiative Advisory Group	*1998 - present*

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Scholarships, Fellowships, Grants and Contracts

A total of 2.6 million dollars were awarded in grants to G. Reid Lyon from 1978 until 1990. Examples are provided below:

Funding History [Selected Grants]:

Special Education Program Evaluation Contract *1989 - 1990*
60,000 awarded by the Bennington-Rutland Supervisory
Union, Manchester, Vermont.

Gundersen Medical Foundation Research Scientist Award *1988 - 1989*
$40,000 awarded by the Gundersen Medical Center, LaCrosse, Wisconsin.

Foundation for Children with Learning Disabilities Grant
$75,000 awarded to study early intervention with reading disabled children,
LaCrosse, Wisconsin (PI: Jane Flynn).

Office of Special Education Research (USOE) Grant *1987 - 1989*
$210,000 awarded to develop methods to address individual differences in classroom settings.
(Grant Number: LD85.0295)

Foundation for Children With Learning Disabilities Grant *1984 - 1986*
$75,000 awarded to develop clinical heuristics for effective interventions with learning disabled children.

NS R01 268197 - Nosology of Reading Disorders in Children: Intervention with validated
subtypes. $521,000 direct costs. NINDS/National Institutes of Health *1980 - 1983*

NS P01 54426 - Classification of School-Age Learning Disabilities

$600,000 direct costs. NINDS (PIWilson); Methodology Core PI: Lyon *1984 - 1989*

Office of Special Education Research (USOE) Grant assessment and intervention procedures
with learning disabled children (OE 2232). $160,000 Direct Costs. *1978 - 1981*

Fellowships

Full tuition scholarship and teaching fellowship awarded by the University of New Mexico *1973 - 1978*

Full tuition scholarship awarded by North Carolina Wesleyan College *1971 - 1973*

Honors and Awards

New England Lifetime Achievement Award for Contributions to Research in Reading and Learning Disabilities	200
The Simpson-Ramsey Distinguished Scientific Lecturer: In recognition of Outstanding Contributions to the Development of Children – Civitan International Research Centers	200
The Samual T. Orton Award from the International Dyslexia Association for Outstanding Contributions to Dyslexia Research	200
International Dyslexia Association - The Normand Geschwind Lecture Award	199
Kingsbury Center 60th Anniversary Award for Outstanding Research in Learning Disabilities	199
National Institutes of Health Director's Award for Scientific Leadership of Neurobiological and behavioral studies to identify and treat critical factors in reading development and disorders	199
NICHD Director's Staff Recognition (Cash) Award	1997, 1998, 199
National Institutes of Health Director's Award for Scientific Leadership in Neuropsychology and Learning Disabilities	199
NICHD/NIH Performance Award	199
Expert Appointment as Psychologist, Human Learning and Behavior Branch, National Institute of Child Health and Human Development, National Institutes of Health	199
Research Scientist Award, Gundersen Medical Foundation, LaCrosse, Wisconsin	198
Elected to Fellow status, International Academy for Research in Learning Disabilities	198
Outstanding Research Award, Division for Learning Disabilities, Council for Exceptional Children	198
Dissertation Honors in Neuropsychology and Special Education, the University of New Mexico, Albuquerque	197
Doctoral Degree awarded with Distinction, the University of New Mexico, Albuquerque	197
Elected to Phi Kappa Phi, National Honor Society	197
Master's Degree awarded with Distinction, the University of New Mexico, Albuquerque	197
Bachelor of Arts Degree in Psychology awarded with highest honors, North Carolina Wesleyan College, Rocky Mount, N.C.	197
Elected to Omicron Delta Kappa National Honor Society	197
Bronze Star Medal, Vietnamese Cross of Gallantry with Palm (Unit), Army Commendation Medal, Combat Expeditionary Medal, Combat Infantryman Badge, Parachutist Medal, Vietnam Service Medal, Vietnam Campaign Medal (5 Campaigns)	1968 - 197

Editorial Boards

The Clinical Neuropsychologist

The Journal of Learning Disabilities

Learning Disability Research and Practice

Learning and Individual Differences

Learning Disability Quarterly

Developmental Neuropsychology

Journal of School Psychology

Invited Journal Reviewer

Journal of Educational Psychology

Journal of Experimental Psychology: Human Learning and Perception

The Journal of Consulting and Clinical Psychology

The Journal of Clinical and Experimental Neuropsychology

The Journal of Experimental Child Psychology

Learning Disabilities Research

Annals of Dyslexia

Teacher Education and Special Education

Child Development

Reading and Writing

Science

Nature

Professional Certifications and Experience

Certified Psychologist (Doctoral Level):	Vermont, North Carolina, Idaho, New Mexico
Licensed Educational Diagnostician:	New Mexico
Certified Special Education Teacher:	New Mexico, Vermont
Program Administration Experience:	20 years
Neuropsychology/School Psychology Experience:	20 years
University Teaching Experience:	20 years
Dissertations Directed:	10
Masters Theses Directed:	15
Public School Teaching Experience:	2 years
Public School Psychology Experience:	12 Years

Other Certifications/Licensure:

Commercial Pilot: Licensed to Fly Single and Multiengine Aircraft. Instrument Rated, Commercial Pilot, Single and Multiengine Aircraft. Licensed to Fly Single Engine Seaplanes.

Military Service

Branch: U.S. Army – Paratrooper (Recon)
Dates of Service: May 1967 to May 1970
Combat Service: Republic of Vietnam, January 1968 to April 1970
Combat Unit(s): 3rd Brigade, 82nd Airborne Division; 1st Brigade, 101st Airborne Division (Op Con)

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Center for Development & Learning

208 South Tyler Street
Covington, LA 70433
985-893-7777
www.cdl.org

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